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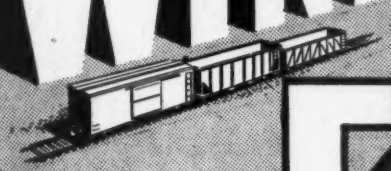

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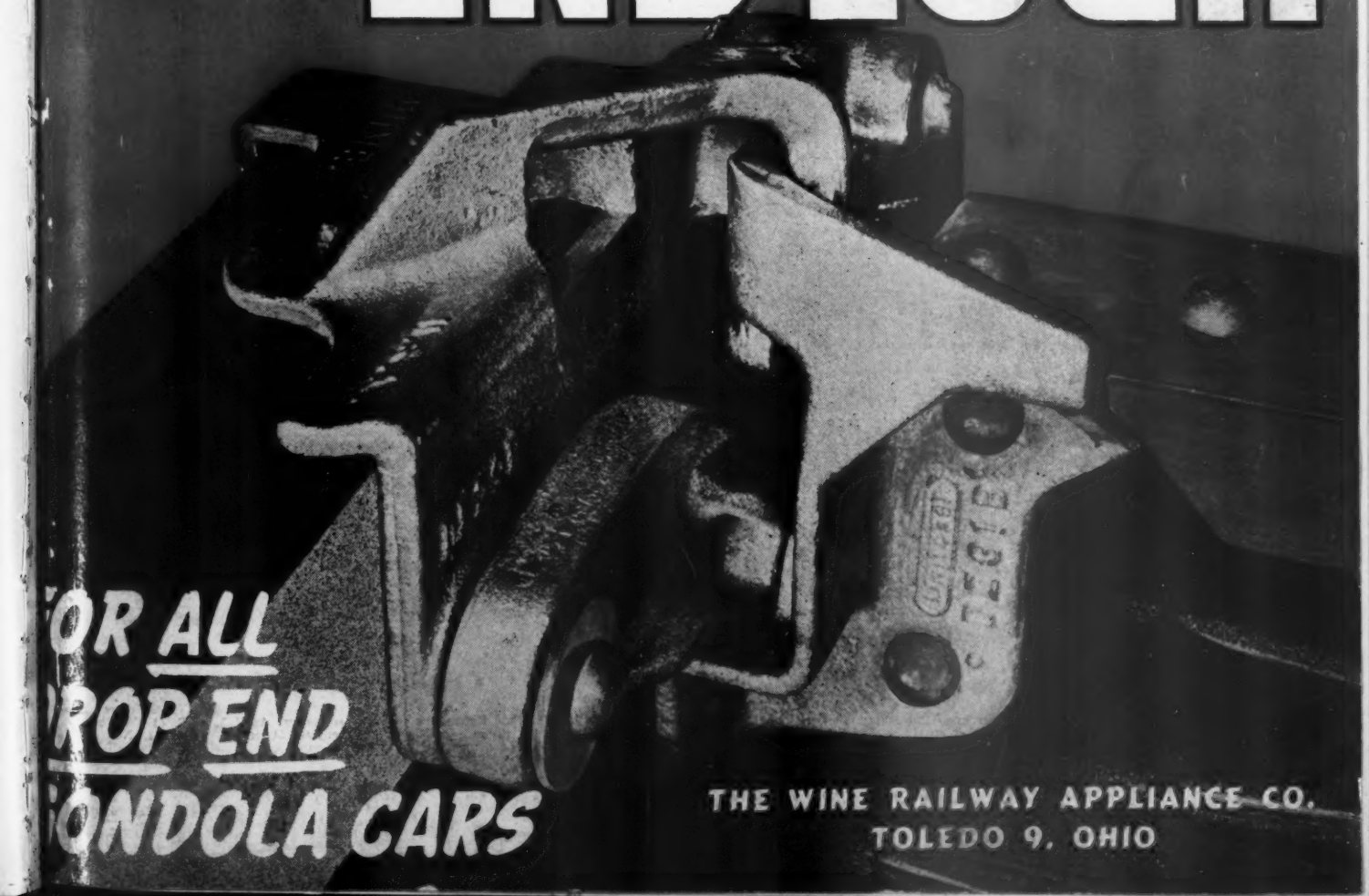

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(Names Registered, U. S. Patent Office)

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Monon Converts

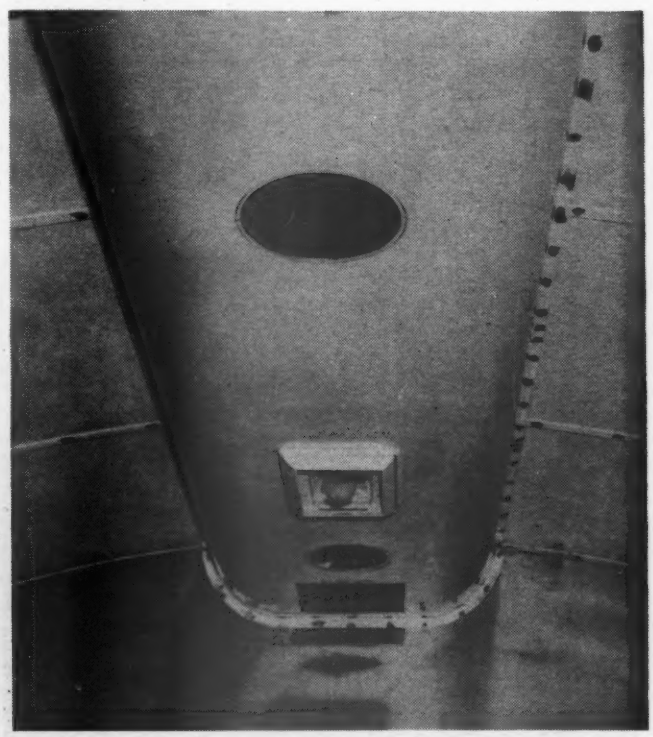
G.I. Cars into Streamliners

Extensive use is made of the original interior equipment in converting hospital cars and troop sleepers into passenger and head-end equipment

THE Chicago, Indianapolis & Louisville is currently engaged in an intensive program of modernization of its passenger-train equipment which includes the conversion of U. S. Army surplus hospital cars, originally built by the American Car & Foundry Co., into passenger cars and baggage-mail cars, and the conversion of troop sleepers, originally tourist Pullmans, into baggage cars. The work is being performed at the road's Lafayette, Ind., car shops by a force that is built around a nucleus of experienced car men supplemented by workers of various trades and classifications no longer needed in the steam-locomotive back shop as a result of the Monon's change to Diesel power.

The hospital cars are being converted into coaches, dining cars, dining-bar-lounge cars and baggage-mail cars, and the sleepers into baggage cars. The completed cars are streamline and have a decorative scheme of "Monon Red" against a light background. This was accomplished with a minimum modification to the body structures and with maximum utilization of the equipment that was on the various cars.

Openings for the windows were cut from the solid sheet with an acetylene torch and ground to the final smooth contour



The countersunk Cherry rivets which were used to fasten the head liner and air duct were filled with a plastic compound and sanded before painting to give a smooth finish

The only major structural change that was made in the cars was the relocation, removal or addition of side posts that resulted from the removal of the evacuation doors, the additional or changed window locations and, in the case of the baggage-mail, the baggage, the dining and dining-bar-lounge cars, the closing off of the vestibule end. Where such changes necessitated new or relocated posts to retain the desired body strength, the posts were arc welded in place.

No changes were made to the six-wheel trucks, although roller bearings are scheduled for application in the future. The 10-kw. axle-gear-reduction-driven generators and the 1,000 amp.-hr. batteries were retained. The

ice-activated air conditioning system was left intact, although future plans call for its replacement with a mechanical system. Roofs were retained except on the first baggage car. In this car a turtle-back streamline roof was applied in place of the clerestory roof of the sleeper. The new roof is 14 ft. high and slopes to 13 ft. 6 in. at each end with a standard A. A. R. contour. The remaining baggage cars to be completed in the present program, however, will retain the clerestory roof until their first shopping, when a streamline roof will be applied.

Car Exterior Modified

The exteriors of the cars were modified for both functional and decorative purposes. The evacuation doors, which were located 11 ft. 10 in. from the blind end of the hospital cars, were removed and a new section of the car side was fabricated from 11-gauge steel integrally with the existing side. The exterior doors in the coaches and parlor cars were not disturbed. The blind end was retained to provide more room for the passengers without reducing the seating capacity of the car. The metal in the car sides was covered with Insulmat to prevent corrosion and to absorb and deaden sound. Holes for the windows, where installed new or relocated, were cut out with an acetylene torch and ground to a smooth contour and finished with a portable grinder. The window panes are set in rubber; they were secured in place between the car side and the interior trim with aluminastic cement. A steel skirt 3 in. deep which curves inward at the bottom extends the full length of the car and slopes to a depth of 6 in. at the ends. It was arc welded in place, ground and puttied to a smooth finish for painting.

Additional modifications were made to the parlor-observation cars, the dining, and the dining-bar-lounge cars. Three large windows were installed in the observation end of the parlor car, which has a square end section. Two are in the ends and the third in the end door. In the two types of diners the vestibule end was removed and the space used for the refrigerator.

Hollow Cherry rivets that were later to be covered with a batten strip, as those on either side of the seam, were countersunk to permit the use of filler—Where not covered they were plugged with knurled plugs to close the hole in the rivet

Interior of a hospital car at one of the early stages of reconversion

Two types of sliding doors are used for handling baggage and mail. In the baggage-mail cars the doors were constructed from sheet aluminum and extruded aluminum channels. They slide on Z-bar slider tracks. Two of the doors are 6 ft. wide and two are 8 ft. wide, an 8-ft. door being placed opposite a 6-ft. door.

Interior of the Cars

While maximum use was made of the original interior equipment of the hospital cars, considerable work was performed in the relocation of part of the original equipment and in the installation of additional equipment and materials to modernize the cars. New equipment, varying in amount depending on the type of car, was added to all cars. Existing equipment was relocated in two ways. Some of it was relocated in the car in which it was originally installed, while part of it was moved from one car to another.

The existing heating systems were removed from both the hospital cars and the troop sleepers. In the passenger cars and the baggage-mail car this was replaced with the Vapor unit fin-type zone-heating arrangement, which is covered with a stainless steel heater guard in the passenger cars. In place of the heating system which was on the troop sleepers, the units removed from the hospital cars were installed.

The original lighting fixtures were retained in the baggage cars and in the baggage section of the baggage-mail car with no additions. In the passenger cars the original lighting was retained in part but supplemented with additional lighting. The mail portion of the baggage-mail car, which conforms in every detail to the specifications of the Railway Mail Service, has new lighting and new windows. The electric locker was removed from the hospital cars and a smaller one substituted. The air-conditioning ducts were removed from both the baggage and baggage-mail cars. Non-skid steel flooring was applied to the baggage section of the baggage-mail car and to the entire floor of the baggage car. The steel floors were screwed in place and welded at the seams. Interior sheet steel was fastened in place with Cherry rivets.

Suitably drained fish racks were installed at one end of the baggage car. A clothes locker, desk, flush-type toilet, and wash basin were added to the baggage car.

In the coaches the vertical air-conditioning pipes and ducts, the evaporator and the electric locker were left in place, the piping and duct work being extended to compartments where necessary. The water cooler, lavatory equipment, Anemostats, ceiling lights, and the baggage racks were retained but relocated.

Intensive use was made of the equipment found in each hospital car that was converted to either a dining or a dining-bar-lounge car. Kitchen equipment from other hospital cars that were converted to coaches, parlor cars, and head-end cars was used to increase the food-preparation capacity of the two types of dining cars. Among the hospital-car items in use in each kitchen are two ranges, a broiler, coffee urn, steam table, pantry locker, cupboard and sink plumbing. All sinks have three compartments to conform to the latest requirements of the U. S. Health Department. Exhaust fans from the original cars are used to remove overheated air and cooking odors from the kitchen. A new kitchen floor of non-skid steel was screwed in place and the seams welded together. The hallway beside the kitchen has an outlet for the conditioned-air duct to counteract the heat transmitted through the kitchen walls.

Interior Decorations and Appointments

Modern and pleasant interiors are attained in all cars by the extensive usage of stainless steel, Flexwood and plastics, both transparent and opaque, on the visible surfaces of the car. Fastening methods, using arc welding for strength members, and plastic cement, Cherry rivets and self-tapping screws for decorative materials, are largely concealed. The heads of the Cherry rivets were countersunk, and the depressed surface filled with a plastic to present a smooth surface for painting. In some cases the rows of rivets were covered with a batten strip; where this was not done the hole in the hollow rivet was closed with a knurled plug.

Application of the insulation and framework for the false ceiling

The interior of the finished coach with individual reading lights and wide-vision windows

The coaches contain 46 seats made of foam rubber with backs of form-fitting resilient springs. Both the backs of the chairs and the foot rest are adjustable. All are arranged so that passengers may look out of windows without interference from pier panels. Venetian blinds, which may be raised, lowered or the slat angle adjusted by a push-button handle, are installed on the twin-pane, hermetically sealed safety-glass windows. The window sills are of Formica, which is scar, stain and cigarette proof. Decorative effect and protection from draft to the passengers occupying the seats at either end of the hallway side of the car are provided by a panel on each end of the seating compartment. This panel is 41½ in. wide by 85 in. high. It is composed of Marlite in the lower section and Lucite above.

The hallways at each end of the cars have a minimum width of 2 ft. 5 in. Additional space is provided where needed, as at the drinking-water cooler, where the width is 4 ft. 5 in. There is a large ladies' lounge with chairs and a settee at the vestibule end of the coaches. At the blind end is a large smoking lounge for occupancy by either men or women, and a smaller lounge for men.

An individual reading light is installed over each window seat to provide good lighting for the occupant of this seat and the aisle seat next to it. The ceiling contour over the seating compartment was left unchanged in the cars converted thus far, but on later cars a lower false ceiling will be applied to give the appearance of greater width and length. A flat ceiling 7-ft 2¾ in. high is applied over the hallways and compartments at each end of all cars.

Interior doors and partitions are made of Met-L-Wood, and the partitions secured in place with angle iron. The upper half of the partitions is primed for painting, while the lower 30 in., where subject to scuffing from baggage, as in hallways, is covered with stainless steel. This metal is also used for the toilet floor and for

the tubing upon which the luggage rests in the baggage racks. Tubing is used here to attain an open construction for easier cleaning and to make the baggage visible from below to minimize passengers forgetting items. The main structural part of the baggage rack is aluminum.

A soiled towel receptacle, unique in many respects, was designed and built by the shop forces. It has the sloping top usually found in public places for waste collection, with a spring hinge opening to receive the used towels. The side opposite this is toward the wall and is open, which permits reaching it with one hand to lift it clear of the holder and dump the contents through this same opening.

The interior of the dining-bar-lounge car was styled by Raymond Loewy. It contains a dining compartment with tables for 24 persons, a lounge section with seats for 20 people, and a bar. The lounge section in the car already completed contains leather-upholstered settees, built-in seats, end tables, arm chairs and black plastic horse-head lamps. The bar, like the lamps and pictures also features decoration based on the Kentucky Derby. The bar is made of stainless steel with a wood frame and is covered with leather. This leather facing is held in place by gold-plated horseshoes. On the second dining-bar-lounge car, the bar will have a decorative motif based on the Indianapolis auto races; the bar leather will be held by miniature automobile wheels.

A false ceiling is used in both types of dining cars. In the completed car this is flat across the top and continues in one piece into a false side through a short radius. The false side extends down about one foot and terminates in a continuous lighting cone. A stipple finish is given to the false ceiling and wall. Vinyl and Flexwood are used for the walls; both have a cloth backing and are cemented in place.

Parlor-Observation Car

The parlor car has a stateroom complete with chair, settee and private toilet, a lounge and observation section, and a main seating section with a capacity of 25 passengers. This is equipped with Roto-Cline wing-back parlor chairs with air-foam leather-covered arm rests, air-foam cushions, and form-fitting backs. Over each chair is an individual reading light recessed in the overhead hat rack. Running the entire length of the seating section is a shelf 7-in. wide at the bottom of the windows for holding purses, gloves, drinks, etc. The shelf is covered with Formica.

The observation-lounge section of the car is set off from the seating section by a glass partition and has room for eleven occupants. It is arranged to offer exceptionally good visibility to passengers who wish to view the passing scenery. The end of the car is square and contains three large windows. Facing these windows are two double seats, along the sides of which are two five-foot windows in the sides of the car to give full 180-deg. vision. Behind the two double seats facing toward the rear of the train are two single chairs on each side of the car which are set at right angles to the double seats. Continuing forward, there is a three-seat combination on the left side of the car, so arranged that its occupants face the rear of the train.

Vinyl and Flexwood were used extensively in the interiors of the observation section and the parlor section for the wainscoting and pier panels. The evaporator and the air-conditioning pipes from the hospital cars were moved to clear partitions and to make the evaporator accessible for inspection and repair. As with the other passenger and the dining cars, the old heating system was removed and Rador heating equipment installed.

* * *

Vista Dome cars for the Chicago, Burlington & Quincy

A Review of

Valve Motion Developments*

Effects of sustained high speeds—Requisites for a successful valve gear—Progress in the design of detail parts—Outside factors affecting performance—The Franklin System of Steam Distribution

The subject of valve motion is more important now than ever and will remain so because the most efficient use of steam at the prevailing price of fuel coal is imperative. The necessary requisites for a successful valve gear are relatively simply but difficult of fulfillment. They are first, the cost must be low; second, maintenance should be a minimum; third, the gear should stay in adjustment between shoppings; fourth, the gear should produce speed and economy, and fifth, it should give reliability in service.

The fact that almost any type or design of valve gear will give dependable service on switch or slow-speed locomotives

W. C. Wardwell,
Chairman

clearly indicates that speed is the crucial factor in valve-gear operation. Certainly, stresses in valve gears increase with the speed, cut-off, and weight of valves and the inertia forces vary as the square of the speed and, as sustained high-speed becomes an ever more important factor in operation, it becomes necessary to place particular emphasis upon valve-gear design and construction.

Valve Gear Design and Construction

Most desired is a valve gear with demonstrated reliability and low maintenance costs. These call for a design incorporating straight thrusts and easy angles with parts proportioned to preclude vibration and distortion. Equally important is the matter of bearings with emphasis upon pins and bearings of ample size arranged for double shear. It has been demonstrated that single-shear pins will not stand up in high-speed service.

To obtain maximum strength and stiffness with minimum weight it appears to be desirable to use channel-section eccentric rods, combination levers and radius bars.

Considering the grueling service to which valve gears are subject, it seems imperative that materials having high resistance to shock and fatigue be used in valve-motion parts. One of the major needs has been a steel with the right properties and lacking sensitivity. Fortunately, such a steel has recently been produced. This is a low-carbon-manganese-vanadium which seems to possess all of the desired properties.

In the past, there has been some reluctance to utilize the higher strengths of high-carbon and alloy steel for the reason that special handling is required. In this connection, it should be borne in mind that abuses which have been customary in the handling of soft carbon steel become dangerous with the harder steels, whether of straight carbon or alloy .

Although it is desirable to give forgings of low-carbon-manganese-vanadium material a simple normalizing treatment, the physical properties are not greatly impaired if it is omitted. Hence, parts of this steel may be treated by torch or forge fire with no temperature control or subsequent heat treatment. Thus, it becomes possible to make alterations involving lengthening, shortening, or straightening in the shop or enginehouse without detrimental effect to the properties.

Aside from affecting valve events, lost motion greatly increases the shock load on the valve gear and reverse gear The application of needle or floating-bushing bearings eliminates the play inherent in friction bearings and, hence, correct valve movement is maintained for long periods. Needle bearings require little lubrication. On the other hand, floating-bushing bearings require greasing more often, but are less sensitive to the grade of lubricant provided. Needle bearings have inner and outer races with the pins a drive fit in the inner races. The pins are thus not subject to wear.

Efforts have been directed toward refinements in the design of detail parts and considerable progress has been made in this direction in eccentric cranks and Walshaerts gear links. The latest skeleton type eccentric crank with large hub fit and double-bolted construction is light in weight and stands up in service. Skeleton construction also has been extended to include Walschaerts gear links. This design eliminates the cheeks and substitutes trunnion cradles, thus reducing the weight considerably. An element of weakness developed in the attachment of these cradles to the link, but this has been corrected by increasing the area of the bolting surface and by use of four bolts instead of two.

Another feature in link design worthy of note is the tendency toward a much wider link slot. This gives the link block more bearing surface and, hence, is in the direction of reducing wear. Furthermore, it makes possible the use of needle or floating bushing type bearings. Failures due to gaulded link-block pins have been too frequent and a corrective would seem to be the use of these bearings.

An interesting sidelight bearing upon the subject of link blocks is the attempt to eliminate link blocks and substitute either roller or floating bushing type bearings. This application calls for a perfectly hardened link and force-feed lubrication.

Walschaerts and Baker Valve Gears

The Walschaerts and the Baker valve gears have demonstrated ability to meet present service requirements insofar as dependability is concerned. They have much in common. Both are activated by eccentric cranks and combination levers which derive their motion from the main pin and crosshead.

Walschaerts Gear

Within its limitations of valve travel the Walschaerts gear can be designed to give the utmost in service dependability. Optimum results are obtained when the design embodies a long link combined with short eccentric-crank throw. This restricts the link swing and cuts down the working angles of the eccentric

* From a paper presented before the annual meeting of the Railway Fuel and Traveling Engineers' Association held at Chicago September 15-18, 1947.

rod and radius bar. In addition, the restriction in crank throw reduces the whip at high speed which occurs in the eccentric crank and back end of the eccentric rod.

These desirable operating features are, however, obtained at some sacrifice in cylinder efficiency.

Baker Gear

The Baker gear has some capacity for greater travel without recourse to excessive working angles in moving parts.

It has been completely redesigned and a number of improvements, including Multirol bearings with thrust washers for taking up lateral wear, have been incorporated. The shape of the gear has been changed by drawing the two bosses, which support the bell crank pin, in toward the center. This construction reduces the length of the bell-crank hub, thus reducing the weight of the moving part. A crosstie, located just below the bell-crank pin bosses, connects the sides of the frame and makes it more rigid.

One of the most important improvements has been the elimination of the trunnions on the radius bars. This was accomplished by redesigning the reverse yoke to allow the radius bars to hang from pins that are supported on both ends. This type of construction safeguards against breakage of radius bars near the upper end. The bell crank has been redesigned to make it stronger and at the same time lighter in weight. To accomplish this, the main hub was shortened, the flanges were made narrower, and the webs thinner and wider. The gear rod has been shortened at the lower end, reducing the sweep necessary to produce the proper valve travel. This, in turn, reduces the crank circle five inches, which is a highly important feature for high-speed operation.

Formerly, when lateral wear developed, it was necessary to build up the surfaces by brazing, but this work has been eliminated in the new gear by the use of lateral thrust washers which can be replaced when necessary with thicker ones. McGill Multirol bearings have been used quite extensively in place of plain bushings. These require less lubrication and give longer life.

Factors Influencing Valve-Gear Performance

Assuming that the valve gear has been designed to meet requirements and has been properly maintained, what are the causes for recurring troubles? Under ideal operating conditions there would be little trouble experienced.

The importance of getting high quality steam into the valve chamber is well recognized. Modern superheaters are of great benefit in evaporating light carryover, but entrained water, sludge and sediment cause most of the valve-lubrication troubles which, in turn, cause valve-motion and reverse-gear difficulties. Much work has been done toward eliminating carryover through application and use of manually operated and continuous boiler blowdown arrangements and a recently developed steam separator gives promise of reducing carryover. Severe operating conditions, involving long continuous runs at high rates of evaporation, intensify the difficulties and careful attention should be given to blowing down boilers sufficient to protect against any foaming.

Many valve-gear failures have been caused by human errors in operation. Surprisingly often instructions for drifting with sufficient steam to break the vacuum in the cylinder are disregarded and lubrication is destroyed, setting up terrific stresses in the valve gear.

Equally disastrous is the effect of suddenly and substantially lengthening the cut-off at speeds about 50 miles per hour. Experiments made by an eastern railroad in break-down tests made with strain gages attached to eccentric rods have demonstrated that such is the case.

The use of the Valve Pilot helps greatly in holding in check the excessive stresses set up due to misuse of the reverse gear in operation in that cut-off performance can be closely observed and bad practices, whether wholesale or confined to a few individuals, can be controlled by road supervision.

Almost everyone will agree that skill is required in preventing serious slipping of the drivers of modern locomotives. Slipping at start and during acceleration produce the greatest stress in the valve gear, since long cut-offs are then in use and pivoted members swing at their greatest angularity. Walschaert gears with long travel are particularly vulnerable in this respect since a wedging action between the link block and the link is experienced.

During slipping at high speeds inertia effect from high velocities is encountered since driver slipping speeds may then become very high. Slipping is also detrimental to lubrication. In connection with control of slipping, the Valve Pilot is again of great service.

The air reverse gear, although perhaps not a component part of the valve gear, is a very important adjunct and the manner in which it performs is of vital importance. Air-reverse-gear troubles can, in many cases, be attributed to poorly maintained valve gears and improper lubrication and, on the other hand, creeping reverse gears impose serious stresses in valve gears through intermittent lengthening of the cut-off at high speeds. Reverse gears occasionally will move all the way forward, allowing full valve travel at very high speeds.

A satisfactory reverse gear must be properly designed and maintained to absorb the shocks received from the valve gear without creeping or jumping and, in addition, it must be sensitive enough to respond to fine adjustments in cut-off.

Shop Practices Which Reduce Valve Gear Troubles

Bearing in mind that most of the valve-gear troubles originate in the valves, we can profitably give this phase of the problem some consideration. Decidedly, the most important design factor is weight and satisfactory progress has been made in the direction of weight saving. Force-feed lubricators have done much to insure adequate lubrication, but no assurance can be given that oil pipes will not break. Also, there is always the possibility that the oil supply will run out enroute.

The importance of accurately and smoothly bored valve chambers along with finish-turned rings cannot be over-emphasized. Thus steam leakage is minimized, lubrication facilitated, and frictional resistance reduced. All of which means that the duty on the valve gear will be relieved.

A troublesome problem in connection with the operation and maintenance of piston valves is the tendency for the valve bushings to creep apart in service after they have been properly spaced in the valve chamber. Unfortunately, the keeper plugs are not too dependable, and a more positive anchor is required to supplement the usual keeper bolt. Two methods have been devised to back up the keeper plugs. The first provides a metal lock between the end of the bushing and end wall of the steam chest, while the second provides extension lugs on the bushing which extend to the joint face on the front valve heads.

The best insurance against defective material in valve gear parts is close inspection at regular intervals, preferably by the Magnaflux method. Although whitewashing of parts is of some value in detecting fatigue cracks, it does not compare with Magnaflux inspection. By all means, valve-gear parts should be Magnafluxed while locomotives are undergoing heavy repairs. And it is advisable to make quarterly inspections by this method.

Considering the abuse to which valve-gear parts are subjected, it is small wonder that eventually they become fatigued. In view of this it might be wise to scrap parts that have been in service for as long as fifteen or twenty years, particularly if the locomotives are still in high-speed service. This practice is followed on a few railroads, and the results prove that the expense is justified.

Much has been said and written by metallurgists regarding stress concentrations due to the notch effects introduced by poor design, tool marks, etc. Undoubtedly, many progressive fractures result from this cause. Hence the matter of getting proper fillets, rounded edges and smooth finish should be given close attention when valve-gear parts are machined.

This discussion of valve gear shop practices would not be complete without some reference to flame hardening. As every one knows who is familiar with shop work, it is next to impossible to get a dependable job of case hardening. And as a result links and link blocks give trouble in service. It is suggested that parts be of high carbon steel, flame hardened.

The Franklin System of Steam Distribution

The valve motion which is probably being watched with the most interest at the present time is the Franklin System of

(*Continued on page 12*)

Coaling-Plant Objectives*

Consult operating supervisors for best plan of facilities and for workable track layout—Anticipate changing conditions

There have been many changes in railroad operation, labor conditions, and railroad requirements since the last committee report on coaling stations was presented before this association. Competition demands speedier train service. Higher unit labor costs demand a greater outlay of labor-saving equipment. Larger and more costly locomotives necessitate maximum utilization.

The servicing of locomotives, therefore, becomes of vital importance to efficient operation, and the coaling station must satisfy the demand for time saving, convenient utility, and economy. The success or failure of such installations is directly dependent upon the experience and judgment of the men upon whom the decision rest. It has been the practice on some railroads for the management to place perhaps too much responsibility on the engineering department and accept from them plans which appear to be satisfactory, without seeking the approval of the supervisory employees actually involved in the proposed dock's servicing operations. This practice may lead to costly errors and inefficient operation.

The Location Problem

The location of the proposed facility is of material consequence. Both present conditions and possible future changes in operation and equipment should be taken into consideration. In the past it was felt necessary to have the coaling facility as an adjunct to the roundhouse facility. This location has, in many cases, prohibited the operation of locomotives throuch such terminals. Such a concrete coaling station was built at a terminael where it was expected that engines would tie up. Some time later the same management decided to operate train service through this station and found it necessary to build a main-line coaling station and retire the one at the terminal. A large-capacity concrete coaling station was erected near an old enginehouse at an important terminal. When a new roundhouse was proposed, a new location was chosen. The dock was retired and dismantled after serving only a portion of its expected usefulness, and a new coaling station was included at the new location. Thus, the age and adequacy of other related facilities enter into the problem of location.

Because of the ever-changing railroad operation, the type of dock construction—steel or concrete—demands some study. Each type has its own advantages, dependent upon its geographical location and its estimated useful life. It is, however, a fact that a steel dock may be moved to another location if necessary, while a retired concrete dock yields little usable salvage and involves costly demolishment and disposal.

The increased coal-carrying capacity of locomotive tenders should be considered when planning between-terminal coaling stations. The track grade at and near such a location is of vital significance.

The location necessarily must provide sufficient space for the desired track layout. The track layout is a railroad responsibility and is also of sufficient importance to justify a conference of the men destined to handle the actual proposed operation. The docks at terminals should be readily available to mainline locomotives in through-train service, to inbound and outbound hostlers without using the main line, and to switch engines without main-line interference. The dock design should fit the track layout at terminals rather than having the track layout fit the dock design. A very large multi-track coal dock was so placed with respect to the roundhouse that its track layout will not follow of an efficient locomotive handling operation and a material portion of the dock is, therefore, not in use. An experienced roundhouse foremen could have pointed out the error of this location and its track arrangement.

Obviously, the coal unloading track should be of sufficient capacity so that loads and empties may be handled with the minimum amount of switch-engine time and with as little interference with the dock operation as is possible. This track should be so graded as to afford convenience of car handling. Car stops, either movable or stationary, should be installed on the unloading track to allow cars (loaded or empty) to be controlled without liability of accident. Some coaling stations are equipped with car pullers which also act as car retarders. The dock unloading track ought to provide for a receiving hopper opening of not less than 20 ft. so that an entire car may be emptied with one spotting. It must, however, be borne in mind that the length of this hopper opening bears a relation to the depth of the receiving hopper.

Breaker bars are essential both as a protection against large size coal and as a safety measure. Light sprays of water are found to be beneficial to control dust while unloading dry coal. As the content of fines increases, the spraying becomes more of a consideration.

Freezing Problems

The underground spaces, unless properly protected against the accumulation of water, are a constant source of trouble, especially during freezing weather. Shallow unloading pit arrangements are now available. Curtains are also available to inclose the track openings at the unloading pit.

One of the major winter operating problems of our northern railroads is handling frozen coal. The first problem is unloading the frozen coal from cars. The coal in the bottom hoppers where the water has collected is normally frozen solid and must be thawed by the application of heat—usually from heating torches, salamanders, or thawing pits. After the hopper coal has been thawed and freed, a portion of the coal in the interior generally is more or less loose, leaving the top crust, and a layer of frozen coal next to the sides, ends, and floor of the car. At one coaling station having badly frozen coal the use of oil feed thawing pits reduced the man-hours required for unloading by four and five hours per car. An electrically driven vibration machine, called a car shakeout, supported above the car unloading point is lowered to rest on the top of the side members of the car. When current is applied, a rhythmical seismic action, at a frequency of 1,000 cycles per minute, is imparted to the car, loosening all frozen coal from the top, sides and floor after initial heat has been applied to the hopper area in the case of badly frozen coal. This device is intended for constant use throughout the year in rapidly unloading cars broom clean. It is claimed that a normal unloading may be accomplished in from three to ten minutes.

Thought should be given especially during freezing weather to enclosing the track openings of the unloading pits with curtains. If enclosed, a comparatively small amount of heat will materially help in the release of coal from such cars as may be allowed to remain in the heated area.

The second problem is that of coal freezing and becoming immobile in the dock bin. During freezing weahter a very large portion of the coal entering the dock bin is normally saturated with water. Perhaps we should devise ways and means of furnishing carloads of loosely loaded frozen coal, or loose coal from storage piles, or from dead storage bins which may be heated more practically than a live storage bin or a railroad car. In any event, the aim during freezing weather should be to minimize the amount of wet coal which is allowed to enter the dock bin and to keep the dock coal moving.

The methods of preventing the freezing of the coal in the dock bin include electrical heaters on plates at dock outlets,

* From a paper presented before the annual meeting of the Railway Fuel and Traveling Engineers' Association held at Chicago September 15-18, 1947.

steam coils, and heated air. There is a de-icing and drying installation for coal docks on the market which introduces steam into heater tubes placed on bin slopes and enclosed in a vapor escape stack placed at or near the center of the bin. It is claimed that very satisfactory results were obtained under very low temperature conditions with such an installation.

C. L. Hartshorn, assistant to general mechanical superintendent, New York, New Haven & Hartford, reports a successful operation with his adaptation of equipment used during the war for preheating airplane engines. The first unit tried was a model GT 3050 Herman Nelson self-powered portable gasoline-burning heater weighing 312 lb. Canvas ducts from this heater were carried to the chute throats and the highly heated air, fan blown, was directed into the throat of four chutes. With temperatures of 2 deg. F. the chutes so heated remained free and operative. A Janitrol portable heater was also satisfactorily used. We are advised, however, that these heaters have been discontinued by the manufacturers.

Storage and Supply Objectives

The proposed dock bin capacity of live storage (that is, readily flowing coal) and its relation to the operation of docks is worthy of much study by both the operating and mechanical personnel. Since this live storage must be supported at a height sufficient for rapid disbursement, it becomes the major factor in connection with the cost of facilities and its tonnage should be carefully determined. The relationship of the bin capacity and the maximum daily disbursement during each eight hours of the day must also take into account the rate at which coal may be unloaded and elevated during the desired working shift or shifts. At terminals where cranes (on-track, caterpillar, or overhead cinder cranes) are readily available, such equipment may be used in case of dock failure to protect the coaling operations. This should be considered in relation to dock bin capacity.

Thought should be given to a facility that would provide a moderate live storage in an elevated bin together with a materially larger tonnage of readily available dead storage perhaps in a silo bin or in a bin encased in the supporting structure of the live storage bin. The dead storage bin floor, sloped toward the hoisting bucket or buckets, should rest on the ground. The dead storage should be handled by the same elevating machinery and be an overflow from the live storage to be re-elevated as required. Such arrangements are now in service at commercial plants, one having 135 tons of live storage and 380 tons of dead storage. Such an arrangement would effect a saving in per diem, might save some switching, and would offer protection during times of irregular coal supply.

The next important deliberation centers about the design and the expected results desired in connection with the fuel disbursements. Too often this problem has been approached on the same basis as the handling of gravel. There has been in the past, and will probably be in the future, a demand for different sizes or grades of coal to be disbursed from the same dock. Many conditions arise that justify the construction of a two-bin dock. During periods when the better coals are obtainable only in limited quantities, it is of great advantage to furnish the better coal to the most essential service.

The cost of coal has increased so materially that the subject of weighing devices now carries added importance. During the life of our Association we have seen price advances of over 500 per cent on run-of-mine and considerably greater on the small black sizes. Coal-dock scales seem to be difficult to maintain and do not seem to be used regularly unless handled by a responsible dock man during each shift. It is, of course, a marked advantage to check locomotive performance by actual scale weight.

There are available for railroad use heaters for bin installation, magnetic separators, vibrating screens, crushers, car vibrators, track heaters for thawing, etc. The accumulative experience and the inventive genius of present-day railroad and coal-dock construction engineers are able to meet all reasonable demands for performance.

The operation on branch lines should be carefully studied prior to investing in immobile coaling facilities. The tendency has been to purchase heavier and more powerful locomotives for main-line use; the purchase of small locomotives was discontinued years ago. The time is near when either new light power will have to be purchased or many track and roadbed betterments will have to be made. The lighter power may be Diesel.

It would, therefore, be logical to provide portable car unloaders and flight conveyors for small coaling stations. Under present conditions it would appear profitable and convenient to unload a month's supply, or perhaps more tonnage, on the ground at small coaling stations where the time element is not of importance, for reloading as required. One-half sections of culvert pipe, perhaps 30 in. long, may be laid on the ground at right angles to the track prior to unloading the coal so that a car unloader may be slid under the pile as coal is reloaded.

The quality of coal available is also changing, the tendency being toward a lower B.t.u. value and a higher ash content. Because of limited ash-pan capacity, ash disposal is of greater consequence. If deemed necessary, after due deliberation, it is of vital importance to consider ash disposal along with the coaling station plan. Should water service and sanding facilities be required, these services should also be considered along with the coaling-station plan. All of these services may be had at one engine spotting and the service time element may, therefore, be held at a minimum.

The members of the committee who prepared this report are Glenn Warner (chairman), fuel supervisor, Chesapeake & Ohio, Pere Marquette district; J. B. Bray, president, Fairfield Engineering Company; N. L. Davis, sales manager, Link-Belt Company; W. G. Dietrich, manager, railroad department, Roberts & Schaefer, Co.; W. F. Anderson, manager, construction division, Fairbanks, Morse & Co.; D. E. White, vice-president, Ross & White Company; J. G. Foster, vice-president, Ogle Construction Company; M. C. Ham, Barber Green Company; A. E. DeForest, assistant to superintendent equipment, Michigan Central; W. E. Sample, Superintendent conservation, Baltimore & Ohio; G. E. Anderson, general fuel supervisor, Great Northern; P. E. Buettell, assistant supervisor, fuel and water service, Chicago, Milwaukee, St. Paul & Pacific; R. W. Hunt, fuel supervisor, Atchison, Topeka & Santa Fe; J. G. Crawford, fuel engineer, Chicago, Burlington & Quincy.

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Photo Courtesy of W. A. Lucas

The "New Look" on passenger cars—1868 version—These cars of the Michigan Southern & Northern Indiana (now part of the New York Central) were equipped with dust deflectors

Locating Causes of Undesired

Road Emergency Applications

By R. C. Coon*

A series of recommendations for determining the cause of an undesired emergency brake application to the train or the locomotive under various conditions while on the road

THE timely subject of undesired emergency brake applications on the line of road does not receive enough thought or consideration. This should be given more attention because emergency brake applications do a great deal of damage to equipment and lading. In the course of one year an unestimated amount in dollars and cents is spent which could be saved by close inspection, better maintenance, good operation, and education on air brakes. The failure of equipment that delays the prompt movement of the trains enroute could be eliminated by these means.

Cars

It is absolutely necessary for the engine crews to cooperate closely with the terminal inspectors by reporting the conditions under which the undesired emergency brake application occurred. There are five specific points necessary for the inspectors to know in order to locate the defective valve quickly. This information should be given either verbally or in writing—the latter preferred. The information required is as follows:

1—The amount of brake-pipe leakage per minute in the entire train.

2—How much the brake-pipe pressure was reduced before the emergency brake application occurred.

3—The speed at which the train was traveling.

4—Was the slack in or was the slack out.

5—Did the application occur each time the brake valve was used or was it intermittent.

If possible, it is best to hold the locomotive on the train that had the undesired emergency operation. Generally in two, and not more than three tests, the defective valve can be located and the car cut out and sent to the repair track for attention. We must bear in mind in testing for undesired emergency brake applications that a sufficient amount of time must be allowed for the auxiliary and emergency reservoirs to charge fully, including the quick-action chambers of the emergency portions of the equipment to be tested.

From the necessary information received from the engine crew, the inspectors can quickly determine and classify the portion of the train where the defective valve is located.

Let us assume for illustration, the air brakes went into emergency when the brake-pipe pressure had been reduced 3 to 5 lb. This would indicate the defective valve is in the forward portion of the train. The inspectors will close the angle cock in the center of the train and apply the yard air to keep the rear portion of the train fully charged. The engineman will release his brakes on the forward portion of the train by placing the automatic brake valve handle in running position. The inspectors will allow fifteen to twenty minutes for the equipment to charge. During the charging period, the inspectors will check closely for brake-pipe leakage in the entire train and make the necessary corrections.

Inspectors' Classification

1—When the brakes go into emergency with the first three or four pounds of brake-pipe pressure reduced, the undesired emergency brake application indicates the defective valve was in the forward portion of the train. The application also could be caused by what is known as runaway brake pipe. With a heavy brake-pipe leak in the rear of the train and the automatic brake valve placed in the service position, closing the supply of air from the feed valve to the brake pipe, the pressure in the brake pipe will tend to equalize throughout the train and the quick movement of the air toward the rear of the train from the fully charged reservoirs on the forward part of the train, could, and does, produce emergency action.

2—When the brakes go into emergency on the terminus of the brake pipe reduction, this indicates that the defective valve is located in the rear portion of th etrain. Test the rear portion of the train as outlined.

3—When the brakes go into emergency on the second reduction of the first application of brake-pipe pressure, this indicates that the defective valve did not respond to the first brake-pipe reduction. Release the train brakes, allow the regular charging period and inform the engineman to make a seven-pound brake-pipe reduction. Inspect train and locate car on which the brakes did not apply.

4—When the brakes go into emergency after the automatic brake valve is used with the train speed in excess of 35 m.p.h., and good operation is experienced when the train speed is under 35 m.p.h., the inspectors will inspect the entire train for air-brake equipment that is loose on the bracket or that is mounted above a truck with wheels that have a rough tread. These conditions will set up a vibration when the car is in motion and will retard the normal movement of the air-brake valves. The vibration will also cause the piston to wear a groove in the bushing which will hold the piston in release position until the differential between the brake pipe and the auxiliary reservoir is such that, when the piston does move, it will move to emergency position.

5—When the brakes go into emergency after automatic air brakes are used when the train has operated on the line of road for a considerable period of time without using air brakes, there is a possible chance that the improper type of lubrication was used in the conditioning of the air-brake valve. Locate cars in the train that have been cleaned in the last three to five months and examine their brake valves as possible causes of the trouble. This type of emergency action could also be caused by moisture working into the quick-action chamber of the air-brake valve. During the brake-pipe reduction, the moisture accumulated in the quick-action chamber cannot equalize as quickly with the brake-pipe pressure as would be possible with air, so the differential between the brake pipe and

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the quick-action chamber is such as to produce emergency action. The movement of the emergency piston will dissipate all of the moisture in the quick-action chamber and good operation of the air-brake equipment will be the result for a period of time.

Steam Locomotive Applications

The test outlined for steam locomotives is part of our daily test of air brake equipment. It is our policy to locate defective operating equipment while it is still in the minor stage. Locomotives equipped with the No. 4 or K.M. type vent valves are tested in the following manner:

With the air-brake system fully charged and the automatic brake-valve handle in running position, apply the independent brake so as to have at least 25 lb. brake cylinder pressure. Now quickly move the automatic brake-valve handle to emergency position and promptly back to running position. With this reduction wave of brake-pipe pressure the vent valve should promptly open and remain open for a period of not less than six seconds and not more than fifteen seconds.

After the vent valve has closed, move the automatic brake-valve handle to release position and overcharge the quick-action chamber of the vent valve to main-reserve pressure. Allow at least sixty seconds for the pressure to equalize, after which place the automatic brake-valve handle in service position and make a continuous brake-pipe reduction from 140 lb. to 50 lb. This test will place a very severe test on the emergency piston of the vent valve to duplicate the reduction in the quick-action chamber that is made in the brake-pipe during the continuous reduction with the automatic brake valve.

On locomotives equipped with D-22 H.S.C. or 24 R.L. air-brake equipment, the emergency portion is tested in the following manner:

With the air-brake system fully charged, apply the independent brake, move the automatic brake-valve handle to emergency position and quickly return it to running position. The emergency vent valve should stay open for at least fifteen seconds and not more than thirty seconds. Allow the system to recharge for at least two minutes. Move the automatic brake-valve handle to service position and reduce the pressure in the brake pipe to 50 lb. Emergency action should not be produced with this continuous brake-pipe reduction.

On locomotives handling trains in excess of 100 cars and experiencing undesired emergency action, I would suggest that the locomotives assigned to this type of service be equipped with air-brake equipment with a first-service position and a brake-pipe maintaining feature. This will eliminate a runaway brake pipe when the automatic brake valve is used, which induces undesired quick action. Furthermore, it will improve the operation of air brakes on long trains in heavy service.

Brake Applications on Diesels

On Diesel locomotives equipped with D-22 H.S.C. or 24 R.L. air-brake equipment, when undesired emergency application is experienced on line of road, the following specific points should be reported:

1—Brake-pipe leakage in the entire train

2—How much brake-pipe reduction was made before undesired emergency occurred

3—Did undesired emergency occur during the graduated-release cycle

4—Did it occur each time the air brake was used or was it intermittent

With these facts at hand, the inspector can quickly determine just what special test he should use other than the daily test.

Emergency During Brake-Pipe Reduction

We check the time required to reduce the equalizing-reservoir air pressure 20 lb. as follows: 110 lb. to 90 lb. in five to six seconds; 90 lb. to 70 lb. in seven to eight seconds; 70 lb. to 50 lb. in nine to ten seconds.

At the same time observe the operation of the equalizing-piston exhaust valve in reducing the pressure in the brake pipe. It should be even and regular in the opening and closing, and not exceed a 2-lb. differential with the equalizing reservoir pressure. The brake valve should move freely with regular results.

After this is done, allow the system to charge fully, move the automatic brake-valve handle to service position, and reduce the pressure in the brake pipe four to five pounds. Return the automatic brake-valve handle to release position, and note that the brakes apply and release. Make several reductions of brake pressure, increasing the reduction two to three pounds each time until a total of thirty pounds reduction is made.

In the event the inspector was unable to find the defective valve or to produce emergency action, apply to the individual unit the single-car testing device, Westinghouse Air Brake Company Piece No. 96936, used on passenger-car air-brake equipment. In using this device, close the brake-pipe cut-out cock, release the locomotive brakes, close the cut-out cock under the independent brake valve. Place the handle of the single-car testing device in No. 1 position and charge the brake pipe and air-brake system to 110 lb. After the equipment is fully charged, place the handle of the testing device in No. 6 position ($\frac{3}{16}$-in. orifice) and reduce the pressure in the brake pipe to 50 lb. Observe closely the brake-pipe gauge for irregularities during the continuous reduction.

The service-stability test applied under these conditions is very severe. Units failing to produce emergency action are not at fault for the undesired emergency which was experienced on the road.

There is a possibility of moisture or oil accumulation collecting in the quick-action chamber and, during a brake-pipe reduction, working through the passageway and choke from the quick-action chamber to be exhausted, causing the brakes to operate in intermittent emergency.

Emergency During Graduated Release

When the brakes go into emergency during a graduated release cycle, inspect the H filter for oil working back into the air-brake system. Allow the regular charging period for the air-brake system, and make a 25-lb. brake pipe reduction with the automatic brake. Move the automatic brake-valve handle to release position and build up the pressure in the equalizing reservoir by five pounds. Return the handle to lap position. Observe the pressure fluctuation on the brake-pipe gauge closely. Continue these movements with the automatic brake valve until the brake-cylinder pressure is exhausted. Repeat this procedure of manipulation until satisfied that emergency action will not occur.

If the inspector wishes to use a single-car testing device for sensitive graduated release, he may do so by using the No. 2 position for brake-pipe restoration. With a 25-lb. brake-pipe reduction in effect, seven or eight graduations should be had by a good valve.

When emergency portions are found to produce emergency action in graduated release, the spill-over check is sticking open and emergency-reservoir air will feed into the quick-action chamber. This condition is brought about by oil working back into the air brake system.

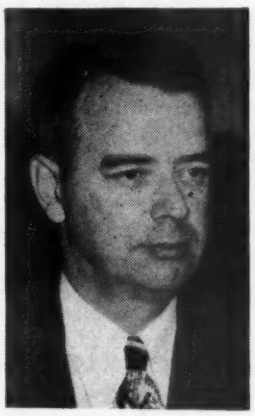
With the application of new air-brake equipment from the air brake rooms, the pipes, reservoirs, and pipe bracket should be cleaned thoroughly with a high-pressure air blast before the new valves are applied.

Freight Car for Modern Needs*

A discussion of freight-car details which need improvement to assure better service and reduced maintenance

The purpose of this report is to present to freight-car and specialty designers and builders a brief summary of freight car defects which we believe must be in large part eliminated if we are to achieve a freight car suitable for modern requirements. Before discussing the matter in detail, a brief review of past requirements and accomplishments is deemed advisable.

Freight cars of this country were originally built to the requirements of the individual car owner and not for interchange. Lading destined beyond owner's rails was transferred at connection points at considerable expense and with resultant delays. In 1866, rules



G. W. Bohannon,
Chairman

were formulated between several railroads to govern the interchange of freight cars and to adopt certain standards such as wheels, axles, journal bearings, brake equipment, couplers and others, so that freight cars could be interchanged between railroads with considerable savings to the parties concerned.

Car department officers had an important part in these original agreements and have continued over the years to exert their influence in formulating and in operating interchange agreements by means of which many basically unsound features of car construction have been barred from further service, and higher speeds and heavier loads have been made possible.

Progress has been slow, largely because of economic conditions, but in recent years we have required the substitution of steel for wooden underframes; outlawed arch bars in favor of cast steel truck side frames; improved couplers; standardized draft gear performance and eliminated the hazard of open brake hangers; promoted interchangeability of parts and appurtenances to expedite repairs. In some instances, standardization has unfortunately tended to stifle progress or improvement.

Shippers are not too greatly concerned about the type of motive power provided, but are interested in the freight car which carries their goods, especially as to its design, size, capacity, condition and suitability for loading their particular class of commodity at a minimum of expense. Shippers expect, and properly so, that the commodity placed in the care of the railroads will arrive at its destination promptly and in good condition.

Modern Requirements Defined

The modern requirements for which freight equipment is to be provided should be carefully defined. We submit that competition from air, highway and water carriers requires that freight train service shall become more dependable than it is at present and that the time required for terminal inspection and repairs must be reduced. Delays en route due to failure of parts and appurtenances must be eliminated in order that cars may be operated over a number of divisions or different railroads without being set out for movement to repair tracks.

We do not expect maximum freight train speeds to exceed substantially those which are now in effect on many railroads, but we do expect that current acquisitions of new freight power will result in higher average speeds than at present. Decreases in station-to-station time will be largely wasted unless substantial improvements are made in the design of certain items of car equipment. We must not lose sight of the fact that present freight cars will not be replaced in the near future and that these existing cars must be operated and for a number of years will constitute the majority of the cars in any freight train which may be assembled. The number of new cars which may be built exactly as we would design them to meet modern requirements will be a small percentage of the total in service for many years to come. For this reason, recommendations which we are making apply not only to new cars but to existing cars as well.

A survey was made of failures of parts which commonly cause most freight car delays. It is regrettable that many of these parts are being perpetuated in old cars and duplicated in new cars under present day interchange rules.

The following statement of three classes of common defects which require bad-order carding to repair tracks was secured from the records of repairs to foreign freight cars made by three railroads for one week. It is on the basis of only one of each part per car. For example, if a car was carded for more than one pair of wheels, the count used was for one pair only. In this study, car wheels constituted 59 per cent of the defects; brake beams, 27 per cent; couplers, draft gears and attachments, 14 per cent.

Equally interesting, we believe, are some figures developed by a private car owner from bills for repairs to truck parts of 450 cars, built and placed in general interchange service during 1940. These cars were considered of modern design and construction as built and the records are based on the first 45 months in service. On the 450 cars, during 45 months of service, the number of pairs of wheels changed on account of defects was 1,560; brake beams applied, 540; brake hangers applied, 457.

We concede that the parts listed are the wearing parts of a car and that it is to be expected that they will be replaced periodically. We do not concede that the ultimate has been reached and that we cannot expect better mileage by substitution of improved designs and materials.

Better Car Wheels Needed

There has been improvement in car wheel design and manufacturing processes in recent years but the quality of wheels in service generally is not satisfactory. The initial cost of wheels is a substantial percentage of new car cost and wheel renewals represent a large part of annual maintenance cost. Delays due to carding for wheels and damage to trucks, superstructure and lading of car caused by unsatisfactory wheels, even though no condemnable, are sources of considerable expense. Less tangible losses result from delays, causing dissatisfaction on the part of shippers, etc. We cannot afford to delay the development and universal adoption of more substantial wheels than those generally in use. Many wheel changes are caused by friction journal bearing failures and until some economical substitute is developed every effort must be directed to the improvement of friction bearing performance.

Standard brake beams not only contribute to repair expense and delays to shipments but, together with their fastenings, constitute

* From a paper presented before the annual meeting of the Car Department Officers' Association held at Chicago September 15-18, 1947.

a serious hazard. Standard brake beams are made up of a number of parts and frequent failures have resulted from separation of the several parts. There are brake beam arrangements available in which the beam is cast in one piece or welded together in such a manner that it may be considered as one piece. Elimination of threaded brake beam tension members and brake hangers and supports is a step in the right direction, but the owners of relatively few of our most recent cars have taken full advantage of these features.

The present cast steel truck sideframe, currently in use on modern equipment, is a decided improvement over the older types, in which practically all truck side failures occur. All of the older type truck sideframes should be removed from service as quickly as possible.

Couplers and Draft Gears Improved

There have been decided improvements in design and construction of couplers. Our study indicated a large percentage of coupler failures but a more detailed analysis proved that most of the failures were with older type couplers rather than with Type-E couplers. It goes without saying that there is little to be gained in applying improved couplers to new cars if the program is not rapidly extended to existing equipment.

Improvements in draft gear design and testing have been notable but we do not understand that the car owner is obligated to provide the latest types of gears in his older cars, nor is there any compulsory inspection or testing. The most obsolete part in our draw gear is the coupler cross key. It is difficult to understand why the cross key was established as a standard in preference to a vertical key and your committee feels that it is not too late to rectify this mistake. Many expensive separations, derailments, and wrecks have been caused by loss of a cross key, which usually depends upon a cotter pin to keep it in place.

The spring cotter or split key is used in many important places in modern freight cars as well as older cars and its failure due to improper applications, or because it has been worn or broken due to improper use, is frequently a contributing factor to failures of other parts of the car. Any design which eliminates the use of cotter keys should be seriously considered.

There are available a variety of snubbing arrangements which can be applied to existing truck coil-spring groups and there are a number of built-in snubbing devices available which are considered essential in the operation of time freights to reduce swaying and bouncing, resulting in damage to or shifting of lading, separations, etc. Snubbing is considered necessary for trucks of the freight car for tomorrow.

Despite the fact that large numbers of cars, especially box cars, are now on repair tracks or in storage yards on account of generally deteriorated condition of body, which is due to deferred maintenance as a result of war-time conditions, it is our belief that present conventional designs of bodies will be satisfactory if periodic repairs by car owners are made. We have no suggestion to make which would radically change the design of the body of the modern car, as compared to many satisfactory designs that have been service tested over the years.

In summary, it is our belief that the freight car of tomorrow must operate at higher sustained speeds with fewer set-outs than is now generally possible. This car may be an existing car or one not yet built, and we are therefore required to raise the standard of much of our present ownership to that of new equipment which may be provided. It is expected that this can be done by concentrating on improvement of wheels, trucks, draw gear, and fastenings of all kinds and that such a program is economically justified.

In the face of increased operating expenses of all kinds and subsidized competition, railroads must improve the dependability of their service. Concerted action by the designers, repair forces, members of the A. A. R. rules committees, all with due authority conferred by financial management, is necessary to secure the benefits awaiting general adoption of "The Freight Car for Modern Requirement."

Discussion

The discussion of this report was extensive and became quite heated in spots. One member maintained that those railroads which remove the most bearings at periodical packing have the fewest hot boxes; that special packing costs some railroads more than they earn; that journal-box packers who simply stir up the packing indiscriminately cause more trouble than good; and that non-A. A. R. wedges cause a large proportion of hot boxes.

Numerous suggestions for change in the A. A. R. journal box assembly were advanced but one member asked if railroads are using what they have to the best advantage. He said that repacked cars will run no longer than determined by the care used in repacking. In other words, the "milk in the cocoanut" is to educate packers so that they do the work correctly.

Another member defended the journal box packer who is not entirely to blame in view of mechanical conditions such as excessive axle movement in the journal box which prevents dust guards from serving any useful purpose in keeping out water, dirt and abrasive particles.

The advisability of establishing a period of less than 15 months between repacking dates was discussed and generally favored, although one member said that strict adherence to this rule would be extremely helpful as many cars are received in interchange which have not had journals repacked for two or three years.

(*The report was accepted.*)

The report was signed by G. W. Bohannon (chairman), assistant chief mechanical officer, Chicago & North Western; L. J. Egeland, traveling A. A. R. inspector, Chicago & North Western; C. H. Green, engineer car construction, Illinois Central; H. L. Holland, mechanical engineer, Baltimore & Ohio; H. S. Keppelman, superintendent car department, Reading; L. Lentz, engineer car construction, Chicago, Milwaukee, St. Paul & Pacific.

Valve-Gear Developments

(*Continued from page 6*)

Steam Distribution with O.C. Poppet Valves. About 14 years ago the Franklin Railway Supply Company began working to produce a system of steam distribution which would successfully meet operating conditions in this country. The limitations of the sliding valves and the imperfections of early attempts to produce a satisfactory poppet valve were realized and in 1939 the fruit of their efforts was applied to a Pennsylvania Pacific type K-4s locomotives.

Tests of the locomotive revealed that at 80 miles per hour the drawbar horsepower was 44 per cent greater than that obtained with piston-valve engines tested. At 90 miles per hour the increase was found to be 54 per cent.

Before the entrance of this country into the war, two other applications on Pennsylvania type 4-4-4-4 Class T-1 locomotives and one application each on the Burlington and Missouri Pacific were made.

Following these applications and after the war, 50 more applications were made to Pennsylvania 4-4-4-4 type Class T-1 passenger locomotives and one to a Pennsylvania Railroad K-4s passenger locomotive type 4-6-2.

One application was next made to a New York Central type 4-8-4 Class S-2a locomotive in 1946.

Five were applied to Chesapeake & Ohio type 4-6-4 Class L-1 locomotives in 1946 and 1947.

The gears applied up to this time were Type A with the oscillating cam*.

One Atchison, Topeka & Santa Fe type 4-8-4 combination freight and passenger locomotive will go in service in October this year and five type 4-6-4 passenger locomotives will go in service on the Chesapeake & Ohio in November equipped with the Type B system employing a continuous-contour rotary cam.†

Extensive road tests of this system of distribution are now being conducted by the New York Central with the S-2a—4-8-4 passenger locomotive, but test results are not yet available.

A summary of the results of test conducted with the Type A system of Steam Distribution on a Pennsylvania Railroad Class K-4s Pacific type locomotive was published in the Railway Age, April 12, 1939.

This report was prepared by a committee of which W. C. Wardwell, master mechanic, N. Y. C., Albany, N. Y., is chairman.

* For a description of this valve gear, see the *Railway Mechanical Engineer* for September, 1939, page 349.

† A description of this gear appeared in the *Railway Age, Daily Edition*, for June 23, 1947, page 1294D72.

New Developments in

Design of Locomotive Boilers*

By A. J. Townsend†

Double Belpaire design proposed as a means of getting more boiler capacity — Greater efficiency obtained by working any boiler at less than its maximum evaporation rate

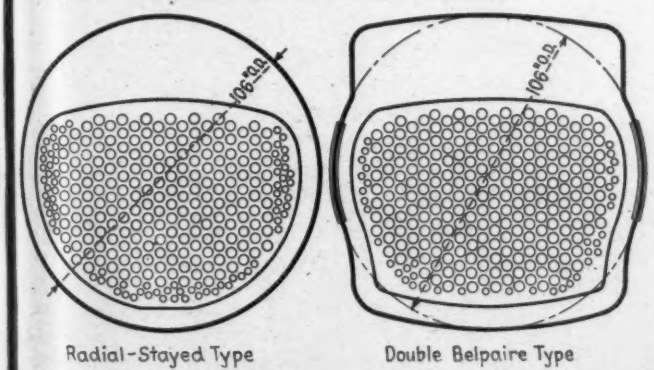
THE mechanical engineer's side of this boiler business is being presented because better boilers have to be designed and placed in service on the railroad to save coal so as to give the boilermakers a job of maintaining them.

[In Mr. Townsend's introduction to the new boiler design he referred to a boiler 25 years old designed with 100 sq. ft. of grate area. He said this boiler had an efficiency of approximately 83 per cent, an evaporation per pound of coal of between seven and eight pounds and because of the large grate area, a firing rate of 60 lb. of coal per sq. ft. of grate per hour. The total heating and superheating surface was 7,268 sq. ft. and the ratio of heating surface to gas area was 680. The excellent results obtained with this boiler showed the designers that this ratio was the right one for good results. Mr. Townsend said boilers of this design are not built any more because of the physical limitations of long locomotives and the requirements for combustion chambers.—Editor.]

One way of getting more tubes in a boiler would be to go back to the Belpaire type of design except to use the same type of Belpaire on the bottom as on the top. A double Belpaire design of about the largest boiler thought possible was worked out and a comparison was made between that boiler design and the best that could be done with a standard radial-stay type. It is shown in Fig. 1. The one on the left is a conventional boiler and the one on the right is what we can do with the double Belpaire construction. Note that the total evaporating surface of this boiler is about 10 per cent more than the standard boiler, the gas area is slightly more than 10 per cent, and 18 per cent more steam area through the units can be obtained, which is quite an advantage because it reduces the pressure drop and packs more power into the cylinders. A good reason for doing that was to get more boiler capacity in order to save coal. That is going to be more important every year from now on.

* One of three papers on new boiler designs presented at the annual meeting of the Master Boiler Makers' Association at the Hotel Sherman, Chicago, on September 16, 1947. The other papers will appear in later issues.

† Vice-president, engineering, Lima-Hamilton Corporation.



Radial-Stayed Type — Double Belpaire Type

	Radial stayed	Double Belpaire	Per cent increase
Heating surface, sq. ft.:			
Tubes and flues	5,327	5,670	6.44
Firebox and comb. chamber	865	890	2.89
Superheating	2,440	2,892	18.52
Firebox volume, cu. ft.	1,341	1,392	3.80
Grate area, sq. ft.	162	162	...
Steam space, cu. ft.	288	363	16.67
Water space area, around combustion chamber below center line, sq. in.	948	1,061	11.92
Steam area, sq. in.	97.21	115	18.30
Gas area, sq. in.	1,805	1,995	10.53

Fig. 1—Comparison of radial-stayed and double Belpaire type boilers

Crowding Boilers Inefficient

Fig. 2 is a chart with the base showing evaporation as per cent of maximum capacity. The vertical scale, the evaporation per pound of coal, is actual evaporation at 300 lb. per sq. in. pressure, not equivalent evaporation. Note that the curve starts at a pretty good slope and them comes up to a dead end, which means that it is impossible to get any more out of the boiler. All boilers, no matter how they are built, follow that same general curve. On some the curve will be up a little and on others down, but the general rule still holds: the more a boiler is crowded the less the efficiency. For instance, at the maximum output only 4½ lb. of water are evaporated per pound of coal, whereas if it is worked at 70 per cent

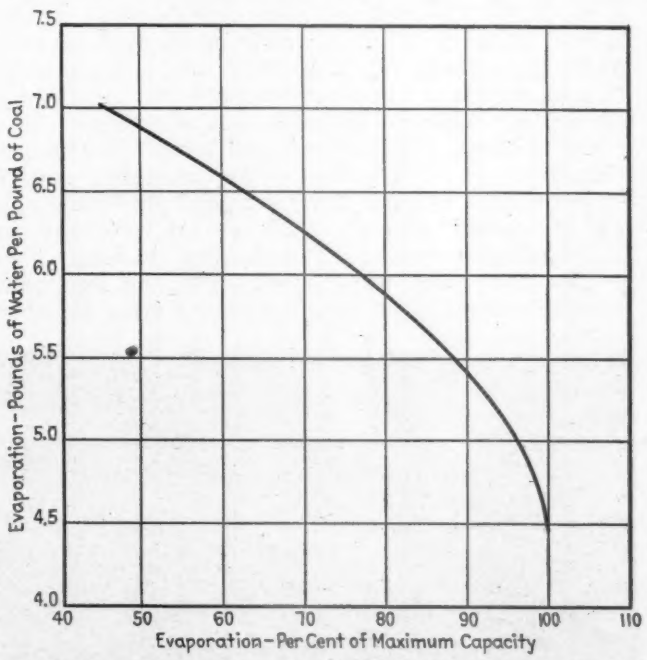


Fig. 2—Curve of actual evaporation at 300 lb. per sq. in. versus evaporation as per cent of maximum capacity shows why efficiency is greater when the boiler is operated at less than maximum capacity

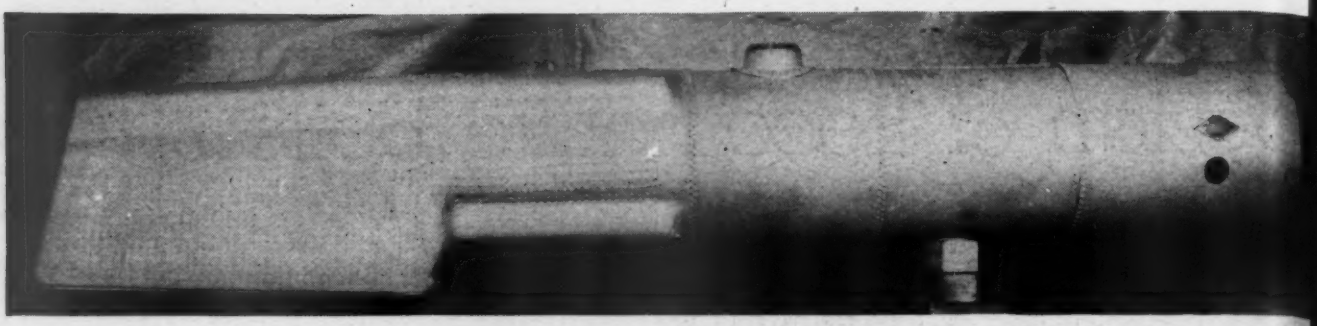


Fig. 3—One-sixth scale model of double Belpaire boiler

capacity 6¼ lb. of water are evaporated per pound of coal. Over a day's run, or put it on an hourly basis, there is quite a difference in the saving of coal.

Scale Model Made and Tested

The shape of this curve isn't anything new; it has been known for years. That is why a locomotive with a bigger boiler shows up better. At Lima, when given a free hand, the boiler is designed as large as possible. There are some things that stop us. Of course, there are weight limitations. A lot has been done with steels in that respect. There is quite a future in welded boilers but that is not enough. The objective was to get something that would jump the boiler efficiency more yet so Lima designed this double Belpaire construction. Then a boiler was made one-sixth of the actual size and it has been subjected to tests in our own shop. It was placed under hydrostatic pressure up to 300 lb. and the deflection was measured every 10 lb. At 300 lb. no more deflection was obtained than at 10 lb. So it is reasonably certain that the boiler will hold its shape. Then the boiler was fired up to 100 lb. and, outside of natural expansion which came equally all over the boiler, no distortion was obtained.

Fig. 3 shows a Belpaire top and bottom and the general shape. In the front end of the combustion chamber on the bottom Belpaire there is a good place to get any size of washout plug and wash out the mud that may collect in the bottom of the combustion chamber. There is also a lot more water space under the combustion chamber—about 12 per cent more water space below the center line of the boiler—which we believe will fee water that much faster back to the legs of the firebox If water is not circulated back there the arch will take lot of it out and cause staybolt difficulties.

Fig. 4 is a better view of the washout plug and it als shows the shape of the bottom half of the combustio chamber. Some men have said, "You can't get that on locomotive, the wheels and the spring rigging won't per mit it." Quite a few sections like that have been lai out and over the rigging a construction like this onl makes about 1½ in. difference, and the same with th driving wheel. This boiler can go on a good many jobs a 70-, 72- or 75-in. wheel, and still keep within heigh limits that are already well known. It is not expecte that it can be used on a locomotive with an 80- or 84-in wheel.

Design Advantages

Fig. 5 shows all large flues where the diagram showe an arrangement of superheater flues and superheate tubes. An expander could not be obtained to fit th small tubes so only the large flues were installed. Tha gives a pretty clear-cut view of the combustion chamber

Fig. 6 shows how the firebox joins the combustio chamber, and it appears that this makes an ideal setu for a completely welded firebox. Having been stayed, w see no reason to stress-relieve it. In our opinion a com pletely welded firebox can be made in most any goo shop and then fastened to a riveted boiler barrel.

A boiler of the same capacity as the old radial-sta

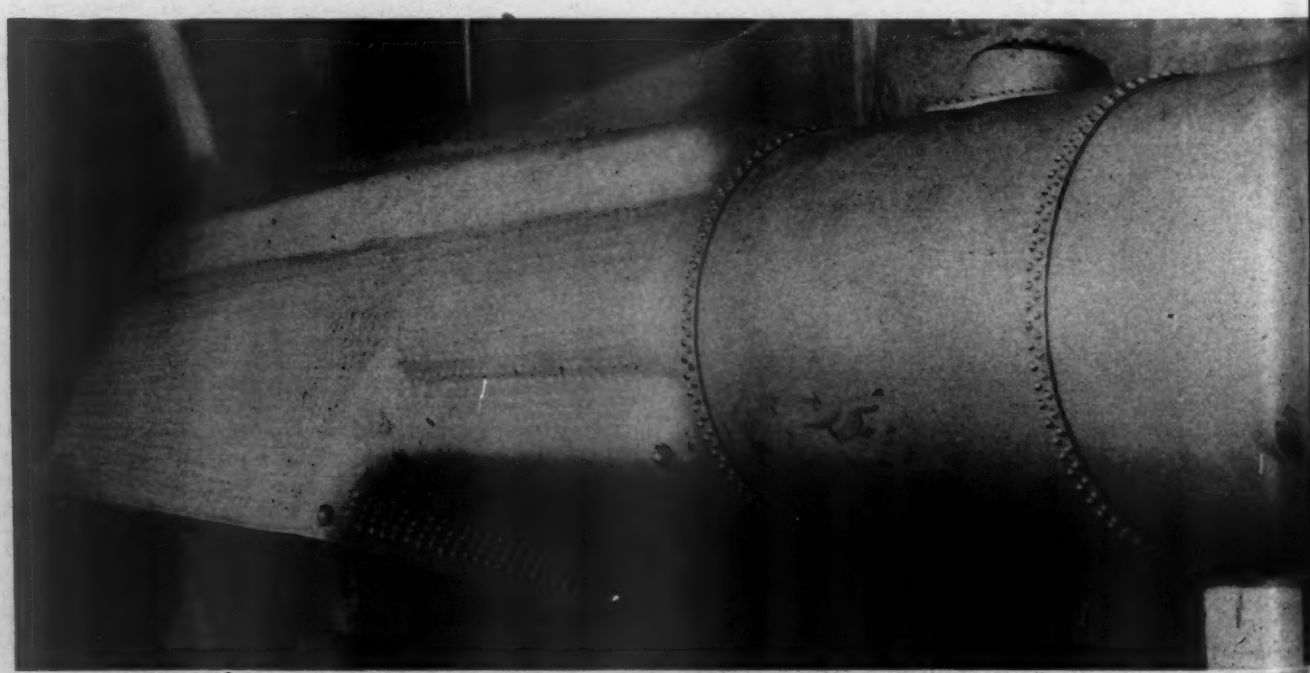


Fig. 4—Washout plug and bottom half of combustion chamber

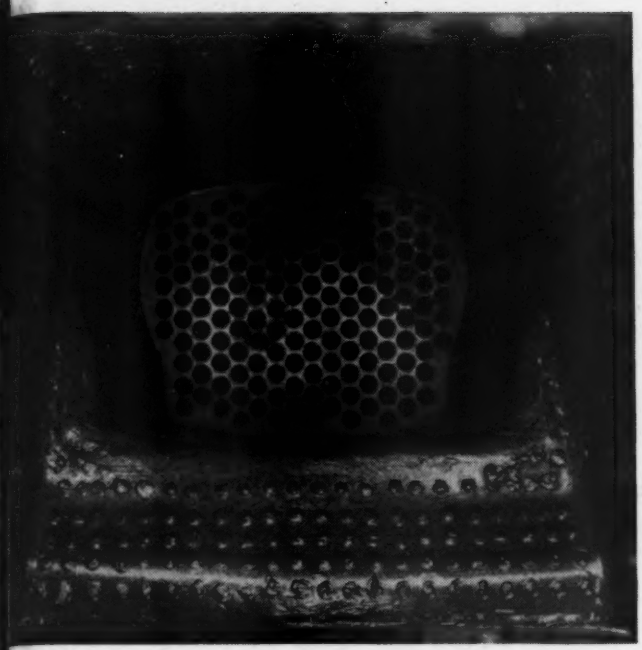


Fig. 5—Combustion chamber and back flue sheet—Only large flues could be used in scale model because expander was not available

oiler can be made a bit lighter. This boiler can be de-igned with just about as much capacity as a radial-stay oiler 3 in. larger. That might be another way of looking t the problem. If clearance is a controlling factor and o much capacity is needed here is a better way of doing it because 10 per cent is quite a bit when that 10 per cent evaporative rate per pound of coal is considered. Nothing has been done about supporting the arch. Syphons and circulators are all good and maybe on a small design somebody would want tubes.

It was mentioned that when we started twenty-five years ago a ratio of total heating surface to gas area of 680 was obtained on that original boiler. With this construction we can get the same ratio, 680. About 690 is the best that can be obtained with a radial-stay boiler but that it close enough to 680 that it is just about all right. So anything can be done with this kind of a boiler that could be done with the other boilers that are known to have been all right and still get that added capacity.

Boilermakers will agree that the more a boiler is forced the more the maintenances. Another advantage of this design is the steam space above the water line, which is very vital. Note on the chart that there is about 16.67 per cent increase in steam space. A lot of boilers have been built that have been deficient in steam space and the trouble shows up with water flying through the units and getting down into the cylinders. One of the designer's problems is to get all the steam space he can in a boiler. In fact, a boiler should not be worked so hard that for every cubic foot of steam space more than 700 cu. ft. of steam per hour are evaporated, but the 700 figure can be reached and still give a pretty good performance. Steam space and plenty of it is needed because everybody is working the boiler for all there is in it.

We have measured a lot of boilers under load to see what the deflection is. They all seem to follow the same general rule of down in the middle and out at the sides, as shown in Fig. 7, and maybe that has something to do with flexible staybolts being used because the breaking zone is up at the top of the side where the boiler changes its shape. It was mentioned that all boilers follow the same rule. They do except that some are worse than others, but they all will come down at least half or three-quarters of an inch at the top. This double Belpaire boiler does not seem to give that deflection at all. Part of it may be obtained with a full-sized boiler. To get a boiler to keep its shape under load is something of an advantage to the trade.

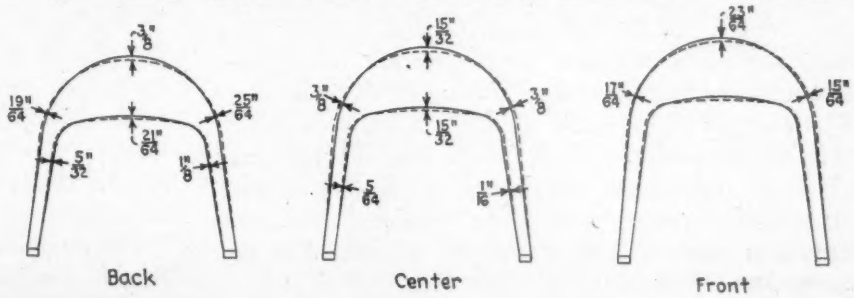


Fig. 7—Deflection of boiler under load—The movement of the boiler down at the middle and out at the sides has not been obtained in the tests of the scale model of the double Belpaire design

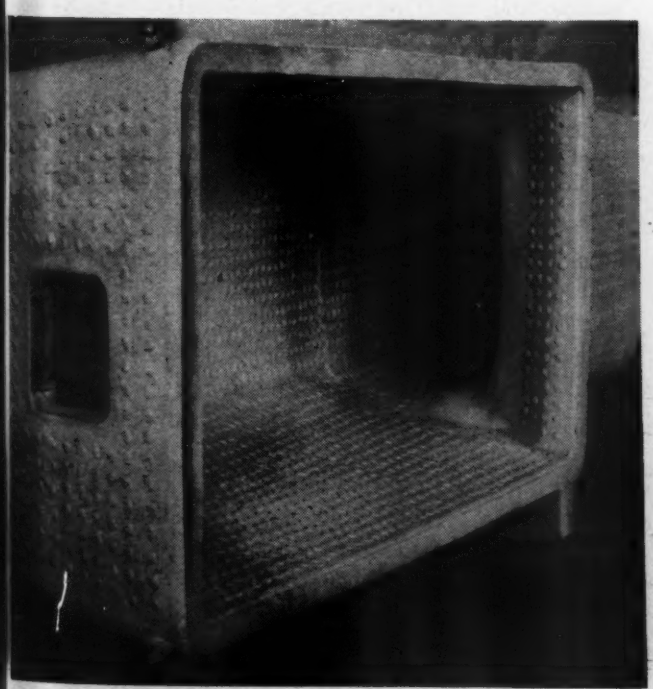


Fig. 6—Intersection of firebox and combustion-chamber surfaces

The Coal Bill Must Be Reduced

We believe that in the future the steam locomotive has got to have an advantage over other types of power if it is going to stay put. Everybody is telling how much fuel they save with the Diesel. They are right; they are saving it. Going back 25 years, and even before that, it was generally figured a pretty good job if a boiler was big enough to meet all the requirements at the cylinder. That does not hold any more because that coal bill must be reduced and anything done to get that boiler bigger, get it oversize and work it at less than its maximum capacity is going to be a step in that direction. We want to get heating surface, superheating surface, grate area, and, above all, gas area, because the stuff burned in that firebox has got to get out.

EDITORIALS

Nineteen Forty-Seven

During the past year progress has been made in several directions of interest to mechanical-department officers and supervisors. This is particularly true with respect to motive power, the interest in which has definitely shifted from steam to Diesel. The trend toward the de luxe coach train has continued; several new trains of this kind having been installed during the year and others re-equipped with new rolling stock. Freight cars probably present the outstanding phenomena of the year—the worst car shortage in 20 years. Orders for shop equipment were predominately for material-handling equipment in the form of cranes, hoists, and trucks.

During 1947 the railroads ordered a total of 1,950 Diesel-electric locomotive units from the several builders, while orders for steam power amounted to 75 units. In spite of this fact the total inventory of locomotives in the United States, 40,072, still represents 88 per cent steam, 10.5 per cent Diesel-electric, and 1.5 per cent electric. In the 10 months ended October 31, 1947, the roads increased their inventory of Diesel-electric power by 524 units and decreased the inventory of steam power by 1,814 units. The retirement of 2,928 steam locomotives is in itself a long step forward for it not only places the burden of handling traffic on relatively newer power, but removes from the active list obsolete power that is uneconomical to operate.

In the field of advanced developments progress was made on the pulverized-coal, gas-turbine locomotive and it appears that the next 12 months may bring forth announcements of interest in this new type of motive power.

The conventional steam locomotive was also in the news by the development of the automatic steam switcher on the part of the Norfolk & Western. This unit has been in service several months and has proved so successful that additional units are being built.

Box-car shortages reached a high between 20,000 and 25,000 for the six weeks from February 15 to the end of March. Open-top-car shortages reached a high which ranged from over 13,000 to nearly 17,000, with the exception of one week, for ten weeks in August, September, and October. Next to the shortages, the outstanding feature of the freight-car situation was the struggle to build up the production of freight cars first to 7,000 a month and then to 12,000 a month. Production exceeded 3,000 a month for the first time in April and almost reached 9,000 a month in November. In the meantime, the backlog of orders built up from 47,977 in January to 125,395 in December.

There is some improvement in the outlook for 1948. One thing is the announcement of the Office of International Trade of the Department of Commerce that export controls will be applied to 95 per cent of the exports of steel-mill products to all destinations except Canada. Another favorable fact is that, slow as it was, some progress was made during the year in stepping up and improving the co-ordination of steel deliveries for car construction. The control of steel allocations was recommended to President Truman by the Harriman committee in order to build up monthly output to 14,000 units. Should this be put into effect, it would approximate the capacity of the car-building industry.

A survey conducted by this publication produced reports from railroads representing more than 90 per cent of the route mileage of the United States and over 90 per cent of the car and locomotive ownership which indicated that orders for shop equipment in 1947 followed much the same course as in the previous year with a few roads entering the market on a large-program basis. There was a continuance of buying for the modernization of shops for wheel and axle work and a substantial increase in the orders for cranes, hoists, and mobile material-handling equipment. The orders for this latter type of shop equipment are evidence of a consciousness that manual labor is an expensive luxury to be eliminated as rapidly as possible.

The establishment of shops for the repair of Diesel-electric locomotives required the purchase of many new types of shop equipment, principally for Diesel-engine and electrical-equipment repairs, which have not been ordered in substantial quantities heretofore.

Electrical Trends

Railroad electrical engineers step into 1948 with one problem settled—with several others unsolved and growing in importance. There is also evident an accelerated use of electrical equipment, which requires that top mechanical officers become familiar with its application, or have competent electrical advisors.

The accomplishment which has been so neatly packaged and placed on the shelf is the standardization of communication-circuit connectors for use between passenger cars on a train. With this threat of demoralization out of the way, the railroads are free to develop the use of telephones, radio, wired music and entertainment features without having unworkable circuit complications when equipment is interchanged.

There are two important questions without answers. One of these is passenger-car power supply. With 8-ton compressors run by 15-hp. motors, 3-kw. of lighting load, blowers, fans, water coolers, perhaps

electrostatic filters and a number of other devices, all of which make important contributions to passenger comfort and convenience, there is little power margin for battery charging on the road. When the batteries must carry the load, they can, in most cases, not be expected to do so for more than two hours. Terminal and yard power standby facilities are generally insufficient and with intensive use of cars, there is little time available for their use. This might be considered fortunate since, as one manufacturer of car equipment states, "The motor (which drives the car generator from standby power) has capacity sufficient to supply power during the precooling period without excessive drain from the battery."

Larger axle generators are one answer to this problem, and several manufacturers are offering another in the form of 25- and 40-kw. Diesel engine-generator sets. These may be the answer to some of the more pressing problems, but none has been in service long enough to establish its worth, and some railroads are opposed to the use of internal combustion engines on passenger cars.

Caboose power supply is not such a pressing problem, but its solution is essential to the development of communication on freight trains. Information must be developed on how much power is needed—whether it shall be supplied by batteries, with or without axle generators, or by internal-combustion engines—what shall be done about standby power, operation and maintenance of equipment—what is satisfactory voltage regulation, etc.

One electrical application which is enjoying some long-deserved attention is shop and enginehouse lighting. Nearly all of the new Diesel service shops and repair shops have lighting which is not in the same category with railroad shop lighting of ten years ago. Now good lighting, with and without the use of functional or dynamic color, is being used in steam backshops and enginehouses with gratifying results. Having adopted light and color for its Huntington, W. Va., shops, the Chesapeake & Ohio reports that production has increased, rejections due to inaccuracy have dropped and absenteeism has decreased markedly.

A Pennsylvania installation of shop lighting trebled lighting intensities and improved lighting distribution. An A. A. R. report on this installation states that it has improved the output of the shop very materially and that it has reduced inferior workmanship and made a marked reduction in reportable accidents, as well as unreportable accidents.

The Pennsylvania has extended such lighting to its steam enginehouses, and the Erie has developed the use of portable lighting units which distribute 35 to 40 footcandles of almost shadowless illumination over the side of a locomotive.

In volume and diversity of application, Diesel-electric locomotives represent the most rapid increase in the use of electrical equipment on the railroads. Diesel engines still require special training of shop forces, but the really new thing in railroad circles is the electrical equipment. It is no longer uncommon to see a master mechanic tracing out circuit diagrams with colored pencils, and a considerable part of the shop force must be more familiar with details than he.

There is now more than 1½ million horsepower of Diesel passenger locomotives and more than 2½ million horsepower each of Diesel freight and Diesel switching locomotives in service in the United States. Present locomotive purchases are confined almost entirely to Diesels, and facilities must be increased to keep up with this growth.

Measuring the Diesel Engine Appetite

A Diesel locomotive during the course of a run over several divisions receives fuel at one or more points. By metering this fuel at each fueling station the amount consumed by the locomotive in pulling its train over the distance from the previous fueling station can be fairly closely arrived at. Knowing the fuel consumption for the locomotive between stations of supply gives a general, though useful, check on the performance of the locomotive, particularly if a record is kept of all runs complete with important data, such as tonnage, slow-downs, stops, etc. Comparison of the amount of fuel consumed on various individual runs with allowances made for the various factors that affect fuel consumption is helpful in locating cases of excessive fuel consumption for the entire locomotive. Where the locomotive consists of a single unit containing a single engine, this is also a good check on the performance of the engine. But where there are up to six engines in use, depending on the number of units in the locomotive and the number of engines per unit, one engine could be at great variance with the remainder either with respect to carrying its share of the load or to its fuel consumption, or both.

Either of these conditions would be difficult, if not impossible to detect unless the variation were an extreme one. In the case of a three-unit, six-engine locomotive, the fuel consumption of one engine could be 18 per cent high, but the effect on the total fuel consumption of the entire locomotive would only be 3 per cent, an amount too small to be noticed normally because of the many variable factors involved which introduce a margin of error of this amount or more. An even more difficult case to detect is where an engine of two or more is handling either more or less than its share of the load. As the excess or deficiency would be compensated for by the remaining engine or engines, the slight change in the overall fuel consumption that might result from the difference in efficiency compared to all engines dividing the load equally would be virtually impossible to detect from the changed consumption of fuel. Either excessive fuel consumption of one engine or unequal division of load between several engines could be detected easily only

by measuring the fuel input to each of the several Diesel engines that comprise the total locomotive.

The close adjustment of load between engines that could be maintained by metering the fuel to each individual engine would lessen alternate overloading and underloading of the Diesel engines, thereby spreading the work and the wear evenly among the several power units. While progressive maintenance may be flexible enough to handle different amounts of wear on different engines, toleration of varying wear between the engines does not seem to be good practice. Measuring and recording the amount of fuel consumed by each engine could help to predict injection system and other troubles earlier than they would otherwise be found. The metering of fuel to the individual engine can aid in keeping fuel costs and maintenance costs to a minimum by reducing the unbalance of work done by each engine. The careful study of, and experience with, a record of individual-engine fuel consumption can lead to possible uses of such a record as a careful guide in predicting and locating engine troubles. The ever-increasing cost of correcting these troubles, as well as the continuing rise in the price of Diesel fuel oil, make the time ripe for utilizing to the fullest the advantage of easy measurement that liquid fuels possess.

Safety-Minded Shop Supervisors

Looking into the new year, one of the most important resolutions which railway mechanical supervisors can make is, by example and precept, to promote safer operation in their respective departments, and this statement applies with equal force whether the individual departments are in locomotive shops, car shops, enginehouses, rip tracks or coach yards. In fact, the mere naming of these various subdivisions of mechanical maintenance shops brings to mind special hazards, more or less peculiar to each, which must be guarded against if desired safety in operation is to result.

As strongly emphasized in papers and discussion at the annual meeting of the Locomotive Maintenance Officers' Association at Chicago last Fall, higher railroad management, supervisors and workmen all share in the responsibility for safety, but it is the supervisor who must meet the demands not only for production and economy but for safety, to the fullest extent possible. In the last analysis, he is generally the man with most all-around experience who knows how work should be done in the interests of efficiency and safety, which are so often synonymous.

Obviously, one of the first requirements is for each supervisor to think and act safely, himself, otherwise his instruction will fall flat and be relatively ineffective. It is important that he make sure workmen are provided with proper tools and equipment at all times and especially that he maintain his own and the men's interest in safety by whatever means are found most productive of the desired results. This definitely means something more than putting up a few posters or signs or passing out safety rule books to be read.

One of the reports mentioned stresses the fact that, whereas written instructions are effective with some workmen, others need to be told; some must be shown and still others learn only by doing. Probably a combination of these efforts is required in the average shop where men of all kinds are employed. It has been well said that simply telling men to be careful is not enough, for there is a vast difference between merely telling and teaching, which goes much further and includes every method of instructing, encouraging and, in the last analysis, *requiring* them to work safely.

Still another suggestion, often advanced and followed in a good many shops, is to analyze individual accidents and, to the fullest extent practicable, discover and publicize the causes and necessary remedial action. In all of this work, best results will be secured if it is done with the primary object, not of allocating blame for past mistakes of any individual, but of instructing everyone in means of avoiding such accidents in the future.

Supervisors have the definite responsibility of analying new jobs or operations and making sure, in advance, that no unusual hazards are being introduced. They have a real job instructing new men and apprentices in safe methods of procedure. They need to keep a watchful eye on young men who may be cocky and careless and older employees, so many of whom are now on the payroll and may not be as alert and sure of hand and foot as formerly. All in all, the railway mechanical supervisor needs to be quite a paragon, as indicated in the following quotation, credited to Stunco, Taylor-Forge Club, Chicago:

What Is a Supervisor?

If he is pleasant, he is too familiar.
If he is sober-faced, he is a sourpuss.
If he is young, he doesn't know anything.
If he is old, he is an old stiff.
If he belongs to a lodge, the members expect favors.
If he goes to church, he is a hypocrite.
If he doesn't, he is a heathen.
If he drinks, he is an old souse.
If he doesn't, he is a tightwad.
If he talks to everybody, he's a gossip.
If he doesn't, he is stuck up.
If he insists that the rules of the shop be kept, he is too particular.
If he doesn't, he is too careless.
If he looks around, he's snooping.
If he doesn't, he's unobservant.
If he tries to settle all complaints, he has to have the wisdom of Solomon.
If he worries about them, he'll soon be crazy.
Are there any good supervisors?
Yes, plenty of them and they're not all in cemeteries.

With the Car Foremen and Inspectors

Broken Air-Brake Pipes

By An Air-Brake Mechanic

One of the outstanding problems in freight-car maintenance right now is broken air pipes. Most of the trouble is caused by the way the brake equipment has been installed. There is no standard manner for the installation of the brake and almost everyone has applied the brake where it would be the easiest and least trouble. The brake cylinder will often be found on the same old bracket that held the old cylinder. That would be all right if the old bracket were renewed or reinforced to stand the extra strain without shifting every time the brakes are applied.

The AB brake equipment is much heavier than the former equipment and requires heavier brackets to withstand the vibration that is present when the car is in motion at high speed. If we examine some of the brackets that support the valve brackets, reservoirs, and brake cylinder, we find that they are too weak to stand the vibration and many of the brackets are already broken. Many have been welded in place and the welds are broken loose. Often the valve bracket is loose on the support or the reservoir bolts are loose, allowing the reservoir and bracket to bounce around, breaking the pipes.

These are the main reasons we have so many broken pipes. We will continue to have them until the weak brackets are replaced by heavy ones made strong enough to withstand the vibration.

Another cause of broken pipes at the flange union is the application of the pipes to the brackets and reservoirs so that they are under strain. All pipes should be set to the brackets and reservoirs by heating the pipe in one or two bends where the strain is most likely to be. Then the cap screws should be tightened evenly and firmly. This relieves the strain in the pipe.

For a more efficient, smoother operating brake with less wear we should reduce the cleaning period from three years to two years. Then the lubricant would not be entirely worn out or dried up from exposure to moisture, particularly in the brake-cylinder packing cups and the piston-rod assembly. The latter is exposed to so much moisture that the lubricant soon disappears and the metal rings start wearing and cutting the piston rod.

The feed grooves in the AB valve also collect gum which hardens and partly stops up the feed grooves causing the brake to charge very slowly. This is confusing in the train yard especially where there is no yard air available to make the initial charge of a brake pipe.

Often times the inspector will get in too big a hurry to test the air before the reservoirs are charged, resulting in a lot of brakes not applying and a poor air test. It would be a good idea to install double-pointer air gauges on all cabooses equipped with AB brakes. Have one pointer connected to the brake pipe and the other connected to the auxiliary or emergency reservoir. This gauge would show the inspector and the trainmen when the reservoirs were sufficiently charged to set the brakes effectively. One railroad has installed a few such gauges on cabooses and they are proving very satisfactory.

Men and Cars*

By F. E. Cheshire†

The car design and construction engineers have steadily improved materials,—for example the greater dependable service life of the wheel, the vastly improved air brake, the improvement in design and in material quality of the truck side, and its great superiority over the wooden frame and later the arch-bar trucks of former years, the greatly improved car roof, the reduction of lost service time by the development of car ends of substantial design, and the vast improvement in the material in couplers.

In the evolution of car development, the protection of the men who handle the cars in operation has been adequately considered. It was this which produced the details of the safety-appliance requirements. In orderly-fashion the ultimate in such protection has been incorporated into the basic design of all cars. It is just as necessary, in fact we recognize an overriding requisite, that all conceivable devices for the protection of men who work with cars be incorporated into the structure. I say without reservation that the designers have done that.

(Continued on page 22)

* From an address before the Chicago Car Foreman's Association, Dec. 8, 1947.

† Vice-president (operation) Chicago, Indianapolis & Louisville.

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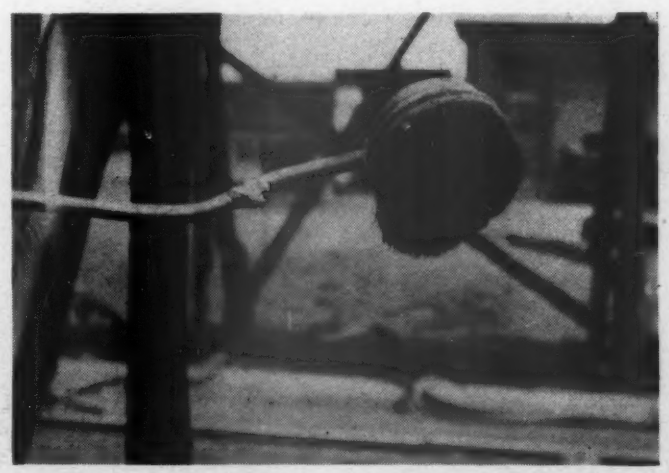


A modified feed which delivers a small stream of naphtha about 6 in. below brushes used in washing cars prior to painting at the Pullman-Standard car shop, Bessemer, Ala.—This was developed from an employee suggestion.

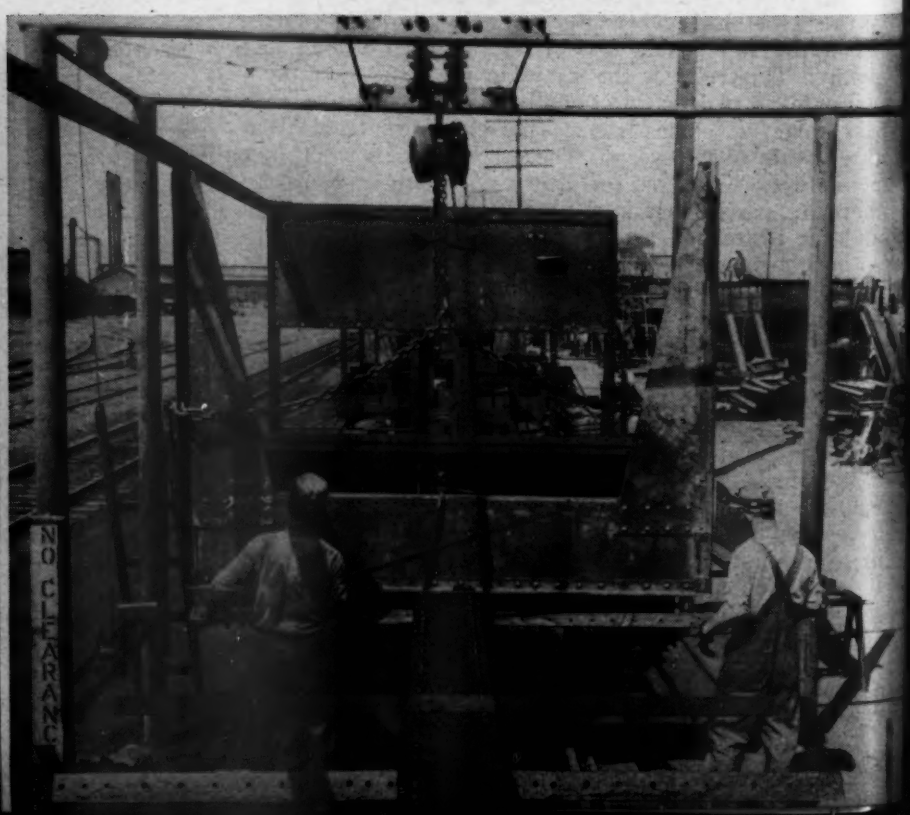
Above: Stripping is carried on at the rate of three cars a day with oxyacetylene cutting torches by one cutter and one helper on each side of the car—Left: After stripping, the underframe is freed of scale and rust with an air hammer and wire brush and a coat of car cement is then sprayed on

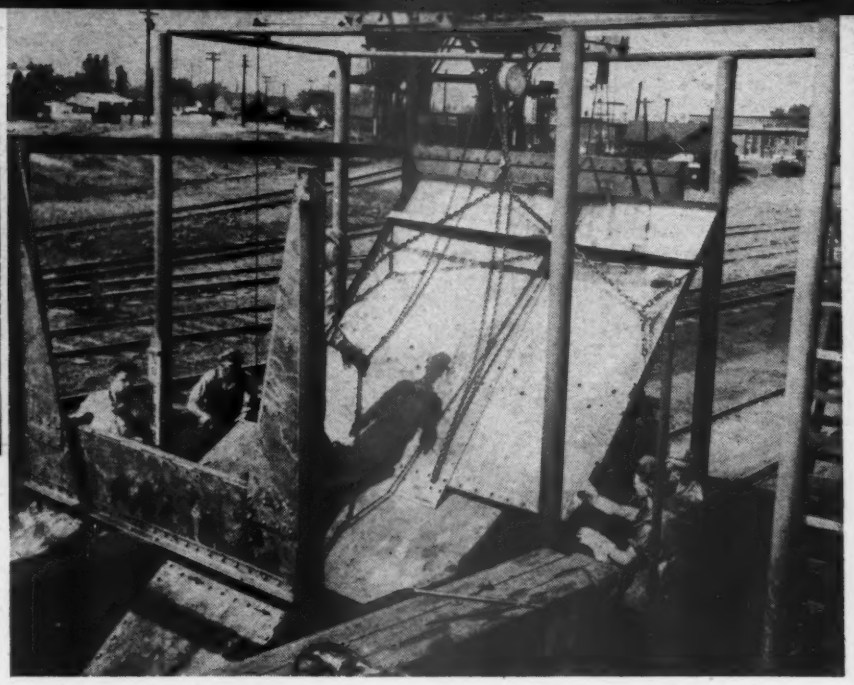
C. & N. W. Rebuilds 500 Hopper Cars

The Chicago & North Western rebuilt 500 70-ton hopper cars at its Winona, Minn., shops in 1947 and plans to carry out a similar program with 500 more cars this year. Cars of the first group, Series 60,000 to 60,499, are A. A. R. design with four hoppers, built of riveted copper-bearing steel in 1927. After 20 years of service, the steel side sheets, slope sheets and hoppers were corroded so as to require complete replacement and, in the urgent need for cars of this type, it was decided to institut heavy car-rebuilding program at Winona shops wh ample track space was available for necessary stripp and assembly operations, as well as storage and hand of the large quantity of new steel and car parts requi

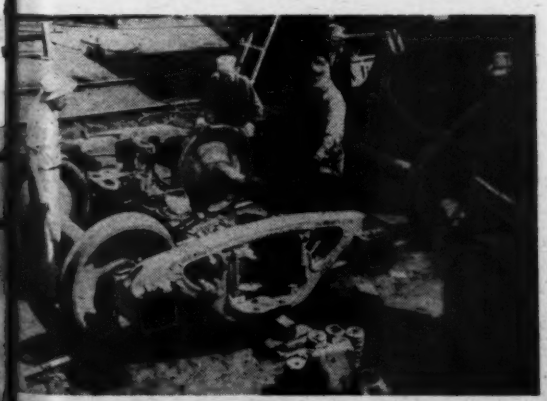
The rebuilt cars are of the same nominal capacity,

Below left: A hole is cut in the bolster web to permit the ap cation of the AB brake cylinder, and the valve and reservoir a part of the piping are applied—Right: The cross-ridge is stalled—Welding is done only on the cross-ridge and bolster





left: Hoppers are placed with a special two-wheel hand —Right: Slope sheets and side panels are applied—The hookup holds the slope sheet at the correct angle—Cars jacked up 8 in. and blocked on trucks to facilitate under- riveting. Riveting from the ground is completed in the position—Next are intermediate and high-level platforms



Above left: The stock for rebuilding is arranged in orderly piles alongside the assembly line—Below center: The high-level riveting platform—Above right: The cars being checked out by the car foreman ready to be weighed—For the fitting and application of hopper doors and renewal of draft gears and couplers the cars are jacked up on horses—The trucks are then thoroughly overhauled (left)

After the cars are replaced on their trucks they are moved to three stub tracks at the west end of the yard where they are placed for painting and stenciling—Both of these operations are performed by the spray method

have somewhat increased cubic capacity owing to the use of panel side sheets. The only parts of the old car bodies saved, aside from underframes, were the top end sheets, and end stakes and side end rails which were relatively free from corrosion. All new panel sides and hopper doors were prefabricated and furnished by the Standard Railway Equipment Company. AB brakes were installed. New draft gears were applied, and new couplers, as needed. A. S. F. Dallman trucks with one-wear steel wheels were repaired and replaced under original cars.

The only changes in physical facilities required at Winona for carrying on the new program work were the construction of low and high-level riveting platforms at necessary points along the two 1,400-ft. assembly tracks and the installation of overhead tubular steel runways with longitudinal and cross-travel carriages to support 1½-ton hoists used in applying the new steel parts. This light crane equipment was particularly helpful at three positions where the cross travel permitted moving slope sheets, side sheets and cross-ridges from assembly positions across the roadway to the car and then longitudinally as required for application to the car. At one point on each assembly line, an overhead platform with suitable guard rails was also constructed to support a portable rivet heater and equipment for delivering hot rivets to the riveting gang at work inside the car.

Other special equipment used included a self-propelled Burro crane with 60-ft. boom for loading scrap, a boom-equipped Krane Kar for various off-track lifting operations and the usual tractor and trailer equipment for moving materials of all kinds. Upwards of 25 portable rivet-heaters were supplied and used at various points as required along the assembly lines, approximately 3,000 rivets being driven per car.

As soon as the work of rebuilding these hopper cars at Winona was thoroughly organized, a production of three cars a day was secured with a total force of 172 men, there being 30 cars in process of construction on the assembly lines and 3 cars on the stripping tracks at all times, exclusive of cars on painting tracks at the west end of the yard.

It was found necessary to supplement the air supply at Winona shops with two booster pumps to take care of the large amount of riveting work which amounted to about 3,000 rivets driven per car or 9,000 rivets a day.

Men and Cars

(Continued from page 19)

And here I reach a point of critical observation. Having lived and worked with carmen, as one of them, for so many years, I feel not only qualified to criticize but obliged to do so by reason of the privilege of added perspective. The men who maintain them have not kept pace with the improvement in design.

Entirely too much time is taken up in making too many inspections of cars. One good inspection is enough to find out what, if anything is wrong with a car, and it is not practically necessary to repeat the process every few miles whether or not it is interchanged. The shipper is interested in the earliest possible delivery of his freight and is entitled to that kind of performance. Too many inspections consume time unnecessarily. It is immaterial whether the inspection is made on the ABC railroad or the XYZ railway. The actual physical condition of the car is the thing and not the individual who inspects it. Years ago there were several gauges on the various lines and trucks had to be changed or the load transferred at junctions. Consistently progressing, the gauges were standardized; yet some lines still elected to transfer shipments to keep their equipment on line. Today equipment is freely interchanged but we still retard the movement of traffic by inspection patterned to the individual line. All carmen can make such inspection as is necessary to provide a condition of equipment that will assure a safe and successful trip to destination barring the rare development of a defect en route. If you can arrive at that premise then the first step has been taken in expediting traffic movement.

Then, with an adequate inspection made, such impairment of serviceability as is shown should be promptly and thoroughly corrected—not just to move the car off line, but preferably to restore complete serviceability. If this is not practicable in some few cases, then sufficient repairs should be made to carry the unit to final destination. Car Inspector, Joe Doakes, of the ABC railroad should be qualified to inspect cars for movement over the XYZ as well as over his employing road. And Joe Doakes' inspection in Saint Paul should be adequate to move the car to New York, barring the rare development of a defect enroute. Then *before* the car is reloaded the necessary inspection should be made. We have no license to interfere with the continuous movement of the customer's shipment. Quite the contrary, we have an obligation to expedite that movement by every means available to the industry as such—to assure expeditious and dependable transportation.

What is here advocated is not new. Individual railroads have done much in the direction of minimizing interference with continuous traffic movement. The further effort required is to extend such commendable practice and include socalled "interchange inspection" in the whole, rather than as an accepted impediment each time a car moves from one railroad to another. Analyze both the necessity and actual benefits of such frequent inspections as are made today—on individual railroads, and in interchange between railroads. Standardize and minimize inspection. No one is better qualified to do the requisite "soul searching" than you—the men who perform and supervise inspection. Modernize these practices to take full advantage of the improvement in the design and materials in cars.

* * *

Looking east through the erecting shop of the new Northern Pacific car shop at Brainerd, Minn.

Flue and Tube

Removal and Application*

By S. F. Wentz†

Removing beads with acetylene torch — Safe ending tubes and flues—Arch-tube application and maintenance

On our railroad we find that removing the beads on a back flue sheet that is not to be renewed can be accomplished in less time by performing this operation with an air hammer and chisel. When the back flue sheet is to be renewed the beads are washed off with an acetylene cutting torch, using a No. 13 cutting tip, in about half the time it takes to remove them with an air hammer and chisel. All 5⅜-in. and 5½-in. flues in the front flue sheet are cut with an acetylene torch using a No. 2 or No. 3 tip, depending on the thickness of the scale. All 2-in. to 4-in. tubes and flues in the front flue sheet are cut by using a gear box that is mounted on a bar and attached to the front end ring and driven with an air motor to which is attached a sliding extension bar, knuckle joints and a tube cutter. An acetylene torch is used to cut the arch tubes about 1½-in. from the flue sheet and door sheet after which the nipples are split and removed.

After the flues and tubes have been cleaned, the surfaces are examined for weight, pitting and indentation, and those found suitable for further service are taken to the cut-off machine to have the rough ends removed, the ends being cut square. It is our practice to safe-end flues and tubes at the firebox end only. The flues and tubes are then polished on the exterior for a distance of about 8-in. on the end to be safe ended, so as to have a good contact in the welding-machine dies. New material is used for safe ends, these being cut about 2-in. longer than necessary. The new safe end is cut on a bevel on the end that is to be welded and is polished on the exterior for good contact and burred on the inside.

The flues and tubes then have the safe ends welded on with a Budd electric welding machine. During this operation, it is important that the dies and rolls are in perfect alinement so as to have a comparatively smooth surface free from laminations, cracks, blisters, pits, bends, buckles and any evidence of unequal contraction in cooling or injury in manipulation. After the flues and tubes have been safe ended they are then tested with air and a soap and water solution for leaks in the welds. Next, they are cut to the number of required lengths for the particular boiler to which they are to be applied and the ends are annealed. It is very important that they are not overheated or burned. The swedge must be uniform and free from die marks. It is important that the heat scale be removed, and that each flue and tube fit the hole snugly, allowing the proper projection for beading, because loose fitting and burned flues and tubes mean longitudinal cracks and broken beads that may not show up on the test but appear soon after the locomotive is placed in service.

When flues have a combined 24-in. safe end and 26-in. of old material, consideration should be given to their use for smaller power, or their use for welding to bring the flue to proper length with a safe end.

One important subject that should not be overlooked is the drilling and reaming of holes in the flue sheets. The sheet should be placed on the drill press in a level position, and the holes drilled ⅛-in. smaller than the required size, then reamed to the finished size and the sharp edges rounded off on both sides of the holes.

After the flue sheet has been applied and riveted or welded as the case might be, copper ferrules are then applied on all classes of heavy power.

In 1941 we applied a set of flues and tubes without copper ferrules to two heavy duty freight locomotives without combustion chamber that had flue sheets containing six 2¼-in. tubes and 247 3¼-in. flues each. After approximately 3,000 miles we started to experience trouble with leaky flues from longitudinal cracks, some developing as many as 15 cracks in one flue, these being renewed along with those where the cracks extended into the prosser recess.

The final result was that one locomotive made 15,000 miles and the other 17,000 miles. At this low mileage it was necessary to renew them and this installation was made by using copper ferrules. On this particular class of power we get 85,000 miles on flues and tubes with ferrules with little maintenance before they go in the shop for Class 3 repairs.

We do not use copper ferrules on switching power and the performance is satisfactory. The flue sheets should be checked for straightness, prior to applying any flues or tubes, and strong backs applied if necessary. The strong backs should not be removed until sufficient flues and tubes have been tightened in the front and back sheets. Usually two vertical and horizontal rows each side of the center line will hold the sheets straight. The location of strong backs, however, generally varies with each individual sheet. The remaining flues and tubes can then be applied and set.

After the final test the boiler is filled with lukewarn water and the flues and tubes welded with shielded, coated electrodes ⅛-in. in diameter, starting at the top of flue or tube and stopping at the bottom center, continuing in this manner until necessary to change position. Then the scale is removed from welds and welding of flues and tubes completed from the original starting point. Rows

* An abstract of part of a committee report presented at the annual meeting of the Master Boiler Makers' Association on September 18, 1947, at Chicago.

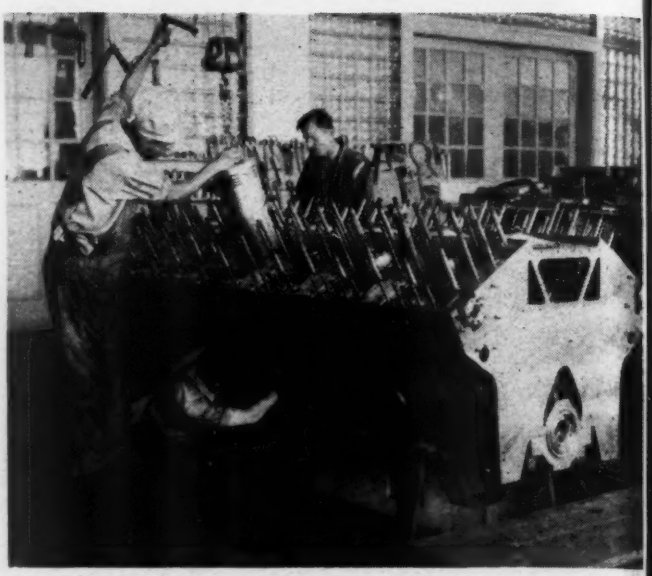
† Stationary boiler inspector, New York Central.

of flues and tubes may be welded horizontally or vertically at the convenience of the workman doing the welding.

We are trying out a Superior three-way flue roller to set 3½-in. flues in the back flue sheet that appears to have considerable merit. However, we have not used it long enough to make a comparison between the methods used in setting flues.

All arch-tube holes are built up with electric welds on locomotives going through the shop, regardless of whether the flue, inside throat or door sheet is renewed. Arch tubes are heated and bent to conform to a template according to the particular class of locomotive to which they are to be applied. After the length has been taken, allowing not less than ⅜-in. nor more than ½-in. for flaring the ends are cut off on a power saw, both ends are annealed and the heat scale is removed from the bearing surfaces. The arch tubes are then placed in the proper holes and held in place with a template of correct spacing for the brick arch and rolled with a seven-roller flaring expander. They are then turbined to remove the mill scale.

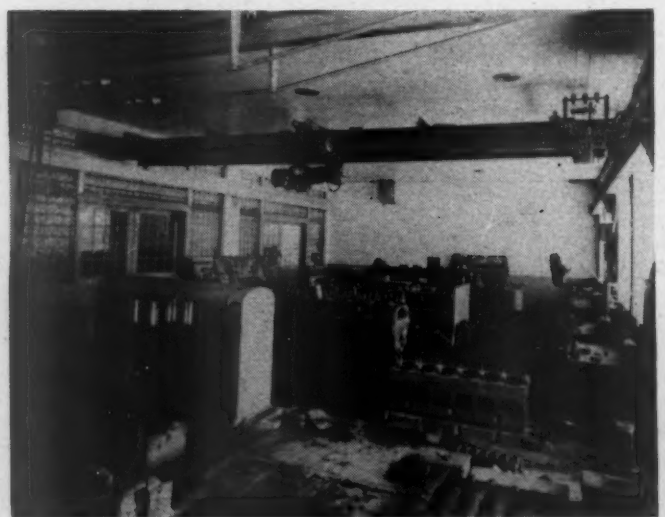
All new arch tubes are stamped on the underside with ¼-in. figures about 9-in. from the door-sheet end abbreviating the shop or engine house and date applied.



An engine undergoing assembly—The man in the pit is standing on one of the side platforms

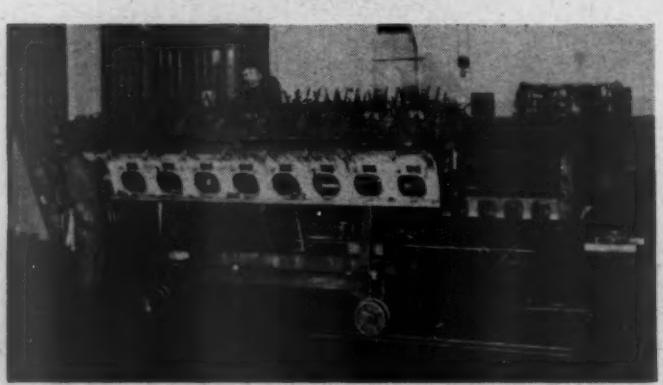
Drop Pits for Diesel-Engine Maintenance

A recently completed Diesel-engine repair shop on the Union Pacific at Omaha, Neb., has exceptional facilities for engine overhaul. The shop which is 66 ft. long and 33 ft. wide, is isolated from the noise and dirt of the adjoining erecting shop. It has three sides made largely of glass brick, providing daylight working conditions. Artificial light is supplied by eighteen 300-watt Holophane lighting units recessed into the ceiling. The shop is served by two one-ton, floor-operated overhead cranes, one electric and the other manually operated.



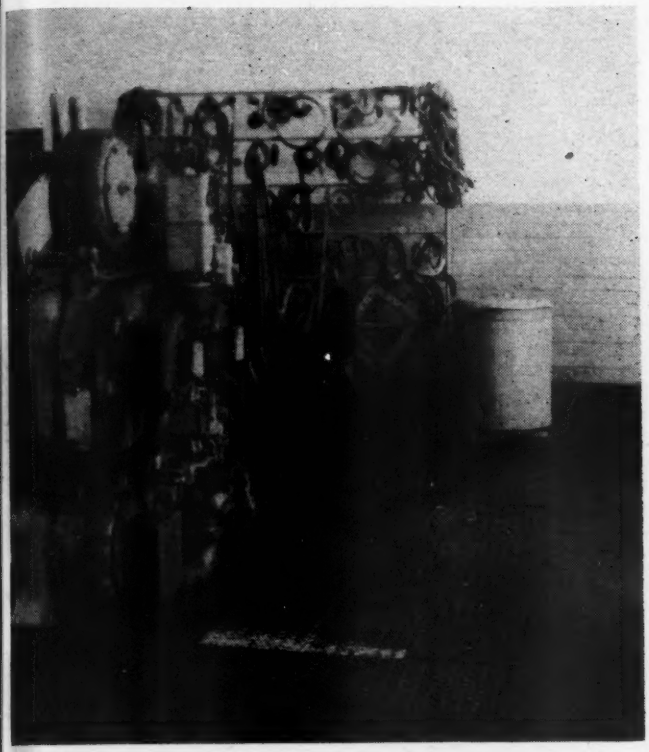
General view of the shop showing the two overhead cranes—The glass-enclosed cabinet in the foreground is used for storing overhauled pistons, rods, and bearings

One of the pits showing the driving motor and driving mechanism and one of the side platforms



The engines are brought into the shop on dollies and placed on the pits

The feature of the shop is two drop pits used to position engines. Each pit is 18 ft. long, 8 ft. wide, 9 ft. deep, and has a shop-built, motor-operated hoist. Four hoist screws, one at each corner, are used to raise and lower the bed on which the engine is placed. Gears and shafts are arranged so that a single electric motor will



The end cover plates are stored in racks in the pit ends when longer engines are being overhauled

operate all elevating screws together. This facility for raising and lowering the engine eliminates the platforms otherwise required for work on the upper parts of the engines. It makes climbing unnecessary, reduces fatigue, and provides safer and more efficient working conditions.

The hoist motors are rated 10 hp. This is sufficient power if the motor has high starting torque. One of the motors which was available did not have this characteristic, but this shortcoming was circumvented by interposing a fluid drive (not a torque converter) between the motor and the load.

Plates, each 12 in. wide, cover the end of the pit when smaller engines are being overhauled. When larger engines are on the pit, one or more of the cover plates are removed and stored in vertical racks built into each pit end. A shelf, or platform, one each side of each pit provides a second or low level for applying lower connecting rod bearings as piston assemblies are positioned from the upper or floor level.

Questions and Answers On Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

Lubricator Drives

Q.—When applying a mechanical lubricator to a locomotive, where is the most desirable location so that the driving mechanism will give a constant drive to the lubricator?—R. E. J.

A.—There are no definite rules governing the application of a mechanical lubricator, as the different types of lubricators and the different conditions found on the various types of locomotives govern its application. The lubricator manufacturers recommend that the lubricator be supported on a bracket, secured to a part of the locomotive where vibration is at a minimum.

The position most often selected is the back of the steam chest on engines equipped with piston valves, a cast-steel bracket being designed to take the studs securing the back steam chest head. This location has proven satisfactory in that, in addition to reducing vibration, it also keeps to a minimum the length of the oil lines to the cylinders and steam chest. The operating mechanism can be driven by the link, combination lever, the valve stem or other moving parts, of the locomotive. When the motion of the part used to actuate the lubricator ratchet lever is variable, the stroke of the ratchet lever used in calculating the oil consumption should be that corresponding to the stroke of the part used with the engine operating at an average cut-off. In order to obtain a constant drive, the connection for the ratchet arm should be made to a part having a fixed motion. A point on the combination lever eight inches below the valve stem guide gives a practically uniform stroke to the ratchet arm on the lubricator. Extending the top of the combination lever and attaching the ratchet lever to it by means of a connecting rod is another means of obtaining a constant drive. This arrangement also keeps the lengths of the operating rigging to a minimum where the lubricator is attached to the back of the steam chest.

Whistle Requirements

Q.—Is it permissable to operate a steam locomotive using an air-operated horn in place of a steam whistle?—A.K.L.

A.—The I.C.C., in Rule 121 for steam locomotives, states: Whistle:—Each locomotive must be provided with a suitable steam whistle, so arranged that it may be conveniently operated by the engineer.

Many roads using steam and Diesel locomotives have added air-operated horns on their steam locomotives in order to have a uniform sound as a warning of the approaching locomotive. These horns are in addition to the steam whistle on the locomotive.

Steam Lap

Q.—What is the difference between inside and outside lap of the valve of a locomotive cylinder? Is one the steam lap and the other the exhaust lap, or does the term apply to the position of the valve?—M.E.D.

A.—On an engine equipped with a slide valve having outside admission the steam lap, the amount by which the steam edge of a valve when in its central position overlaps the edge of the steam port, is often called outside lap. In the case of a piston valve arranged for inside admission, the inside edge of the steam port is the admission edge and therefore the steam lap is the inside lap of the valve. To avoid confusion, it is preferable, regardless of the type of valve, to use the term steam lap instead of outside or inside lap as the case may be.

Press-Fit Allowance For Cylinder Bushings

Q.—What allowance should be made in machining cast-iron cylinder bushings for a press fit? When step boring cylinders for cylinder bushings what depth of step should be provided?

A.—The A. A. R. Manual of Standard and Recommended Practice states that the bushings are to be of close-grained gray iron finished with the outside diameter 0.00025 in. per inch of diameter larger than the bore of the cylinder. The bushings are to be pressed into position with the cylinders cold. Step-bore cylinders are to be provided with a $\frac{1}{8}$-in. step. Many railroads, however, are using a $\frac{1}{32}$-in. step.

Fixtures Are Important In Machining Operations*

The actual machining time on many operations performed on locomotive parts in the average railroad shop represents, in many cases, but a small proportion of the total floor-to-floor time. The difference between actual machining time and floor-to-floor time is consumed in moving parts to and from the machine and in setting up the parts on the machine preparatory to actual metal cutting operations. Included in this article are several examples of fixtures of various types that have been developed to simplify the job of setting up parts on a machine and, as a consequence, reduce this important element of the total floor-to-floor time.

Fig. 1 shows a fixture for holding locomotive bronze frame shoes on a table of a three-spindle milling machine. This fixture is made in two pieces and, as may be seen from the illustration, is adjustable for various lengths of shoes. The shoe is secured with a single clamp on the end of the fixture and by the use of this fixture the setup time is reduced to approximately two minutes out of a total floor-to-floor time of about five minutes. The cutters used on this job are the solid body type with brazed-on tips having a rake angle of five degrees positive axial and radial. The diameters of these 12-tooth cutters are 10 in. and cutter speed 300 r.p.m. with a feed of 30 in. per min. Approximately 200 shoes and wedges are finished with each grinding of the cutters. This job was formerly done on a planer and even with carbide tools the floor-to-floor time was almost an hour.

Fig. 1—The fixture for holding locomotive frame shoes is made in two pieces and is adjustable for various length shoes—The shoe is secured with one clamp at the end of the fixture—Setup time is approximately two minutes

* Excerpts from data included in a report submitted by the Committee on Shop Tools to the Locomotive Maintenance Officers' Association. Other jobs embodied in this report were published in October, 1947, page 580.

Fig. 2 (left) — Machining a valve gear frame complete, including boring and facing the link trunnion holes, with one set-up on a rotary indexing table

Fig. 3 (below left)—A steel frame shoe for a roller-bearing locomotive being milled for phosphorus bronze inserts on a vertical milling machine

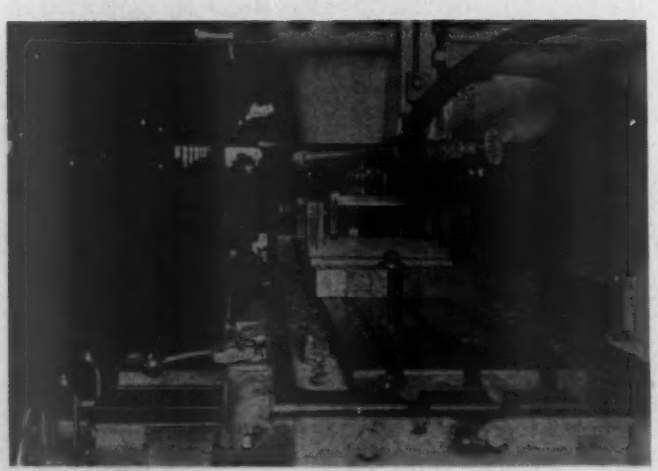


Fig. 2 shows a frame for a locomotive valve gear. Here again the part to be machined is setup in a fixture on a rotary table of a horizontal boring, drilling and milling machine. This fixture makes it possible to do all of the machining operations required on this gear frame with one setup and has made it possible to reduce floor-to-floor time on this operation from about 24 hours to 12 hours. Formerly this job was done on a planer and the slotter required individual setups on each machine.

Fig. 3 shows a simple adjustable holding fixture for machining the steel frame shoe for a roller bearing housing on a vertical milling machine. On this job high-speed cutters are used for milling the phosphorus bronze inserts in the shoe with a feed of three inches per minute and a quarter inch cut. Thirty-five of these

pieces are machined for each grinding of the cutter and by transferring this job to the machine and using the fixture the floor-to-floor time was reduced from four hours to one. The job was formerly done on a planer.

Fig. 4 shows a somewhat similar job wherein an adjustable fixture of the receiver type is used for holding a steel boiler expansion pad on the table of a horizontal boring, drilling and milling machine. In this

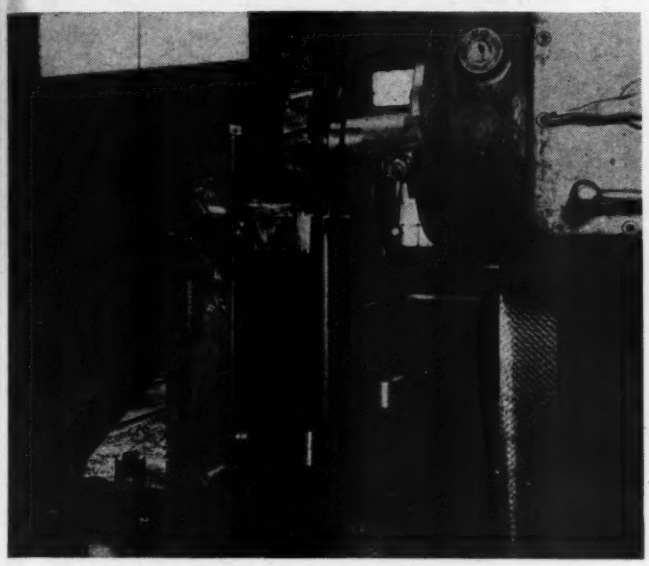


Fig. 4—A high-speed slotting cutter machining a steel boiler expansion pad on a boring and milling machine

case high-speed slotting cutters, having a diameter of 10 in., take a cut a half-inch deep with a feed of one inch per minute and the floor-to-floor time on this job has been reduced from 10 hours to four hours.

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

COMBINED AUXILIARY, EMERGENCY AND DISPLACEMENT RESERVOIR *(Continued)*

592—Q.—What does the Rotair Valve consist of? A.—A pipe bracket *2*, rotary valve seat *7*, rotary valve *15*, case *19* and operating key *16*.

593—Q.—What is the function of the Rotair Valve in Freight position? A.—In this position the rotair valve provides for operation of the controlled emergency feature in emergency application (control locomotive brake cylinder pressure build-up) and the automatic service split reduction feature during a safety control application (service split reduction of brake pipe pressure).

594—Q.—How does the Rotair Valve function in Passenger position? A.—In this position the rotair valve provides for a non-controlled locomotive brake cylinder pressure build-up in emergency application, and full service brake pipe reduction from a safety control application.

595—Q.—How does the Rotair Valve function in Lap position? A.—In this position the rotair valve cuts out the controlled emergency feature, automatic split reduction feature, and independent application and release.

D-24—CONTROL VALVE

596—Q.—What does the D-24 *Control Valve consist of?* A.—Service portion, emergency portion, independent application and release portion. Controlled emergency portion and dead engine portion.

597—Q.—How does the Service Portion function? A.—To control the application and release of brakes in accordance with automatic brake valve handle manipulation or from a safety control application.

598—Q.—What is the function of the Emergency Portion? A.—It controls the emergency brake application to provide high emergency application pressure and power cut-off. It also provides improved emergency transmission and accelerated release after emergency applications.

599—Q.—How does the independent application and Release Portion function? A.—To provide independent locomotive brake application and release as controlled by the independent brake valve, quick local independent release of the locomotive brake and interlocked automatic and independent brake operation.

600—Q.—Where is the controlled Emergency Portion controlled from? A.—The K-2 rotair valve.

601—Q.—How does it function on a short freight or passenger train? A.—It provides for a fast non-controlled build-up of brake cylinder pressure on short freight or passenger trains.

602—Q.—How does it operate on long freight trains? A.—It provides for a controlled brake cylinder build-up on long freight trains.

603—Q.—What does the Dead Engine Cock provide for? A.—Charging of the main reservoirs on a locomotive hauled dead in a train.

604—Q.—What does the Pipe Bracket Portion contain? A.—Quick action chamber, removable strainer, three choke plugs and two drilled chokes in the service portion face, and one choke plug and one drilled choke in the emergency portion face.

605—Q.—Name these choke plugs. A.—Service choke plug *3*, emergency choke plug *4*, emergency reservoir choke plug *5*, exhaust choke plug *8*, graduated release choke *R*, protection choke *Y* and dead engine choke *Z*.

606—Q.—What is the purpose of the Service Choke Plug 3? A.—It controls the rate of displacement reservoir build-up when a service broke application is made.

607—Q.—What does the Emergency Choke Plug 4 *control?* A.—It controls the rate of displacement reservoir build-up from the emergency reservoir when an emergency broke application is made.

608—Q.—What is the duty of the Emergency Reservoir Choke Plug 5? A.—To control the flow of emergency reservoir air to the auxiliary reservoir in direct release position of the graduated release cap during release.

609—Q.—What does the Exhaust Choke Plug 8 *control?* A.—The rate of exhaust from the displacement reservoir when releasing the brake.

610—Q.—What is the purpose of the Graduated Release Choke R? A.—To control the rate of air flow from the emergency to the auxiliary during initial release, and thus provide the graduated release and quick recharge features.

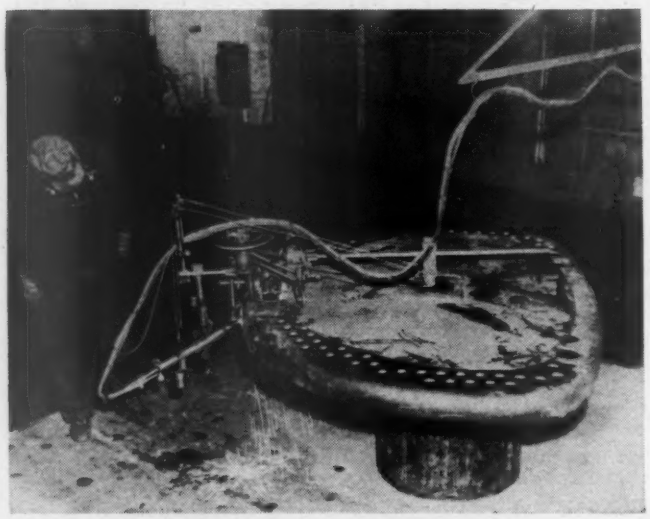
611—Q.—What is the duty of Protection Choke Y? A.—It protects against loss of the emergency reservoir air in case the pipe to the control switch is open.

612—Q.—How does the Dead Engine Choke Z *function?* A.—It permits charging of the main reservoir on a "dead" locomotive without causing a reduction in brake pipe pressure which might apply the brakes.

613—Q.—What provision is made to prevent the three suspension bolt holes in the pipe bracket from accumulating water and freezing? A.—The two front holes are cut away in the middle and the rear hole is protected by a sealing ring. Fig. 15.

Portable Shape-Cutting Machine

The accompanying illustration shows a portable shape-cutting machine with a special attachment which is used for cutting locomotive flue sheets to the correct bevel and height of flange for welding to the fire box. By the use of this portable machine the time on this operation is reduced to about 30 minutes, a mechanic and helper being used on the job. After the cutting operation is completed the scale is removed with a hand-grinder which requires approximately 15 minutes additional



Portable shape cutting machine with special attachment for cutting flue sheets to the correct bevel and flange height for welding to the firebox

time. Before this portable machine was developed the flue sheet had to be laid out and cut off with a hand torch, then the bevel was made on the sheet with a pneumatic chipping hammer and finished up with a hand-grinder. The old method required six and three-quarter hours to complete the job—a mechanic and helper being used on the work.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Radius of Boiler Shell Patch

Q.—When applying patches to the shell of a locomotive boiler, should the inside radius of the patch be made slightly less than the radius of the shell to insure a tight fit when the patch is riveted to the shell?—F.T.G.

A.—In applying patches to the shell of a locomotive boiler, the same practice should be followed as is used for butt straps, domes, dome liners, etc. The radius of the patch should be properly formed, have true radii and be set up metal-to-metal to the shell course, with the maximum opening at any point not exceeding .005 in., nor extending over one-half of the pitch between rivets. There is to be no springing of the patch in place nor drawing sheets together to correct inaccurate dimensions other than tightening the connection for riveting after the sheets have been fitted metal-to-metal within the tolerance mentioned.

Determining Water Hardness

Q.—What is considered as hard water? How is the hardness of water determined?—F.E.M.

A.—Hardness in water is the most widely known evidence of the presence of scale-forming matter in the water. It is that quality in water, the variation of which makes it more difficult to obtain a lather or suds from soap in one water than in another. Hardness is ordinarily classed as either temporary or permanent. Temporarily hard waters are those containing carbonates of lime and magnesium which may be precipitated by boiling at 212 deg. F. and which, if they contain no other scale-forming ingredients, become "soft" under such treatment. Permanently hard waters are those containing mainly calcium sulphate, which is only precipitated at the high temperatures found in the boiler itself, 300 deg. F. or more. The scale of hardness is an arbitrary one, based on the number of grains of solids per gallon. Waters may be classed on such bases as follows: soft water; 1-10 gr. per gal., moderately hard water; 10-20 gr. per gal., very hard water; above 25 gr. per gal.

Hardness in water is tested with soap, using 100 cubic centimeters of the treated water for the test. One cubic centimeter of the soap solution corresponds to one degree of hardness. The soap solution is added a very little at a time and the whole violently shaken. Enough of the soap solution is added to make a permanent lather or foam,—that is, the soap bubbles must not disappear after the shaking is stopped.

Applying Tender Tank Swash Plates

Q.—We are applying new swash plates to our tender tanks by welding the sheets to the original Tee-iron frames, and would like to knqw the equivalent amount of weld that would be required to compensate for the number of rivets used in the original construction.—F. E. H.

A.—As the question did not state the method of welding the swash plates to the Tee-irons, it is assumed that intermittent fillet welds along the edge of the plate and the edge of the Tee iron were used. In calculating the strength of fillet welds, a unit stress of 13,600 lb. per sq. in. is usually employed for tension, shear and compression since in practically every fillet weld shear is present. The safe allowable loads for fillet welds in shear is 1200 lb. per lineal inch for each ⅛ in. of size of fillet weld, e.g. 1200 lb. for ⅛-in. weld, 1800 lb. for $\frac{3}{16}$-in. weld, etc. The length of the weld may be computed using this value, or the accompanying table used. One-quarter inch is added to the calculated length of the fillet for starting and stopping the arc. The crater in the welds should be filled.

Table I—Length of Fillet Weld to Replace Rivets

Rivet size, dia. in.	Rivet sheat value*	Length of welds, in. for fillet size, in.				
		¼	⅜	½	⅝	¾
¾	2356	1¼	1	⅞	¾	⅝
⅞	3682	1⅝	1⅜	1¼	1	⅞
⅞	5301	2⅛	2	1⅞	1⅝	1⅜
⅞	7216	3¼	2¾	2¼	1⅞	1½
1	9425	4¼	3⅜	3	2¾	1⅞

*Based on working strength of 12,00 lb. per sq. in.

ELECTRICAL SECTION

Color and Light for the Shop

By Dorman M. Miller and R. S. Fish*

The Chesapeake & Ohio has greatly improved working conditions in its Huntington, W. Va., shops by use of mercury, incandescent and fluorescent lighting units in combination with functional color for machines, side walls and ceilings

LIGHT and color have been combined so effectively in the Huntington, W. Va., shops of the Chesapeake & Ohio that production has increased, rejections due to inaccuracy have dropped, and absenteeism has decreased markedly. Functional colors on walls, ceilings, and floors, as well as on machinery and equipment, supplemented by adequate lighting properly planned for each seeing task have improved employee morale and made it possible for each worker to do a better job.

These color and lighting aids have been utilized throughout the entire shops. Metal being worked on stands out in three-dimensional contrast. Hazards, such as low beams, edges of platforms and pits, crane hooks, and lift trucks are painted yellow for high visibility. Switch boxes are red. Lighting where close machine work is done has been raised to 40 foot-candles. Coach repair shops have horizontal-plane illumination of 40 foot-candles and vertical lighting of 15 foot-candles on the far sides of the cars and even inside the coaches through the windows.

Effects such as these are achieved only through careful coordination of lighting and color. While certain colors can be combined to give good contrast, pleasing and stimulating to the eye, their light-reflection qualities

* Mr. Miller is power engineer, Appalachian Electric Power Company, Huntington, W. Va., and Mr. Fish is lighting engineer, Westinghouse Electric Corporation, Huntington, W. Va.

Fig. 1—400-watt mercury and 1,000-watt incandescent luminaires are mounted alternately in this high-bay area—Functional color painting and proper illumination have improved production efficiency markedly

Fig. 2a — Typical gallery lighting before the new system of light and color were introduced

may be low. Colors and tints can be chosen to provide good contrast, improve employee morale, and at the same time recover light that otherwise would be wasted.

Light reflection factors of various colors are generally considered to be as shown in Table I.

Table I—Light Reflection Values of Paint Colors

Color	Per cent of light reflection
White	89
Light yellow	78
Ivory	78
Light cream	77
Peach	72
Rose	66
Pale green	62
Light blue	62
Cream gray	61
Light gray	57
Buff	55
Aluminum	42

The colors chosen for the Huntington railway shop are a sunstone yellow and sea-foam green for the walls with a wainscoting completely around the rooms of a deeper, soft vista green. The ceilings are white. Machinery is a bright, focal green with yellow and beige trim; work benches and tables are green and yellow. Motors and electrical switches are painted focal red. The general effect is to let the eye take in various colors instead of absorbing just one. This relieves fatigue.

Operating parts of machinery are painted a color that moves in contrast to stationary parts. This focal color—a bright yellow—instantly draws the attention and focuses it where it should be. Stationary parts that had been painted gray provided a contrast to the yellow, but had a depressing effect on workers. After much experi-

Fig. 2b — Another gallery showing the effect of painting and of replacing the older style lighting fixtures with fluorescent units to produce over 40 foot-candles on the working plane

Fig. 3—Rows of double-lamp fluorescent luminaires mounted at right angles to the tracks provide excellent illumination for coach repairing even inside the coaches themselves

mentation, a color called vista green was produced which soothed and relaxed the eye without any after effects. The brilliant red color of the electrical conduits and switchboxes acts like a constant warning—an important safety factor.

Color has a tremendous influence on the general illumination in the shops. Walls that had been painted gray previously were reflecting only about 55 per cent of the light. Now that the walls are painted with yellow, 78 per cent of the light is reflected with reflection factors of 62 per cent for the pale green walls, and 89 per cent for the white ceilings. Although white has the highest reflection, it should not be used on the walls. If a worker looks up from metal work on a gray machine and rests his eyes on a white wall, his eyes and nerves are shocked by the extreme contrast.

Lighting equipment in the high-bay area shown in Fig. 1 was changed to take advantage of the excellent characteristics of mercury-light sources where luminaires must be mounted high above the working area. White mercury 400-watt units are installed alternately with 1,000-watt incandescent units equipped with aluminum reflectors. The blue-white color of the mercury light sources is supplemented by the warmer colors of the incandescents to give true color perception of the machines and materials. Reflectors are equipped with impact-resisting glass covers to prevent dirt from accumulating on the reflecting surfaces.

Gallery lighting has been increased from less than 5 foot-candles to over 40 foot-candles. Previous illumination was spotty as shown in Fig. 2a. Continuous double rows of 100-watt, 5-ft. fluorescent lamps in closed-end steel reflectors now produce glareless, shadowless illumination for the type of machine work shown in Fig. 2b.

Windows on the west end of the building are painted over to prevent glare from the afternoon sun. The inside surface of these windows is painted a soft, vista green.

The coach repair shops have been similarly improved as shown in Fig. 3. Here rows of two 100-watt fluorescent luminaires are mounted perpendicular to the railway tracks to produce good vertical illumination of 15 foot-candles on the sides of the coaches.

Vapor-proof industrial concentrators similar to floodlights are used in the spray booth shown in Fig. 4.

The overall effect of adequate lighting and functional color painting is to bring a sense of order to an other-

(*Continued on page 38*)

Fig. 4—Special lighting is required in the spray booth where coaches are painted—vapor-proof industrial concentrators similar to floodlights are used to give high level of illumination

Tight Traction Motor Coils

By E. H. Horstkotte*

A method of binding armatures which insures tight coils and bands which will not work loose

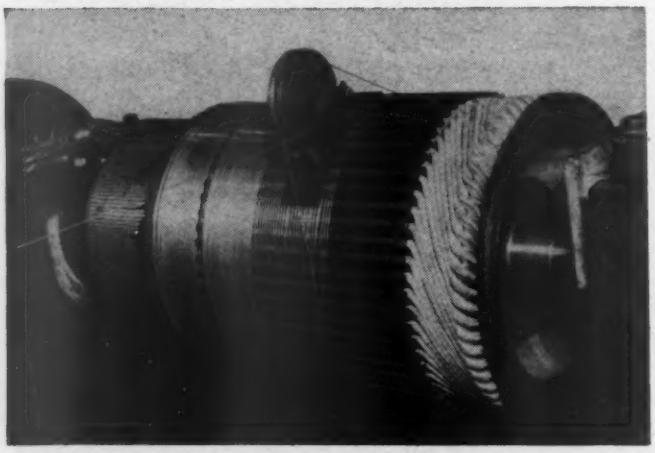


Fig. 1—Armature being bound by the re-reeling method—View shows second step with continuous wire wound over temporary sticks and sheave—the sheave will later be picked up by a tension device as shown in Fig. 2

ONE of the problems in assuring long life of transportation motors and generators, which are subjected to severe vibration such as occurs in transportation applications, is to make sure that the armature coils are held down firmly in the slots.

Otherwise, due to the continuous pounding which these motors receive, the coils may move in the slots and eventually pulverize the insulation to such an extent that a severe short circuit may take place, usually resulting in a major repair job.

To assure the coils being held firmly in position, they are made so that they fit the slot portion of the armature punching as tightly as possible without injuring the insulation when the coils are inserted in the slot.

After the coils are installed in the slots, the armature is brought to a temperature in an oven, which makes the insulation somewhat more flexible. A temporary binding band is applied with a bar of steel in each slot, so as to bring the pressure, due to the tension in the wire, down on the bar. This tension amounts to about 500 lb. for a 0.072 in. diameter wire, so that when many turns of wire are wound around the armature, a relatively high total pressure is applied to each bar.

It is obvious (Fig. 1) that at the start the slot sticks resting on the armature coil will not be pressed down as far as they will be when the winding progresses further along the armature.

If this wire is run back and forth several times with tension maintained in the wire, each time the wire is re-reeled, the armature bar will be pressed more firmly down toward the bottom so as to completely fill the cross section of the slot. Then when the slot wedges are driven into position with considerable pressure on the top of the coil, the hazard of loose coils and bands is eliminated.

In some railroad shops, this is accomplished by means of a lever and pulley system as shown in Fig. 2. With the lever held in an approximately level position by adjustment with the chain hoist, a uniform tension is maintained in the wire, and as the wire is re-reeled by reversal of the binding lathe driving motor, the bars are compressed radially.

Such a method is fairly satisfactory if only a few armatures are involved, and where extreme caution may be taken in case of wire breakage. However, such a scheme is too slow and too hazardous for a relatively large production schedule.

Using this basic idea, the Erie Apparatus Works Laboratory developed this scheme further. It has now been successfully applied to the production line manufacture of transportation motors.

The general scheme of such a lathe is shown in Fig. 3. The armature is mounted in the lathe in the conventional manner with facilities for rotating it in either direction at the desired speed. The temporary binding wire is removed from reel "A," threaded through friction block "B," tension device "X," and over the pulleys, C, C'

Fig. 2—A type of tensioning device used in some railroad shops for applying armature bands—View shows continuous wire being re-reeled to tighten coils—Constant tension is applied by the sheave, lever and weight and slack is taken up by the chain hoist

* Works Laboratory, General Electric Company, Erie, Pa.

and C" under the armature, and around pulleys D, D' and D", and fastened to the armature at "E."

The tension is applied to the wire by means of the friction block "B" and tension device "X" at the desired value. This value is indicated on the meter shown in Fig. 4, which is operated from the electric gauge mounted in the spring ring shown on the same photograph. The spring ring is mounted at point "Y," so that at all times it measures twice the tension applied to the wire.

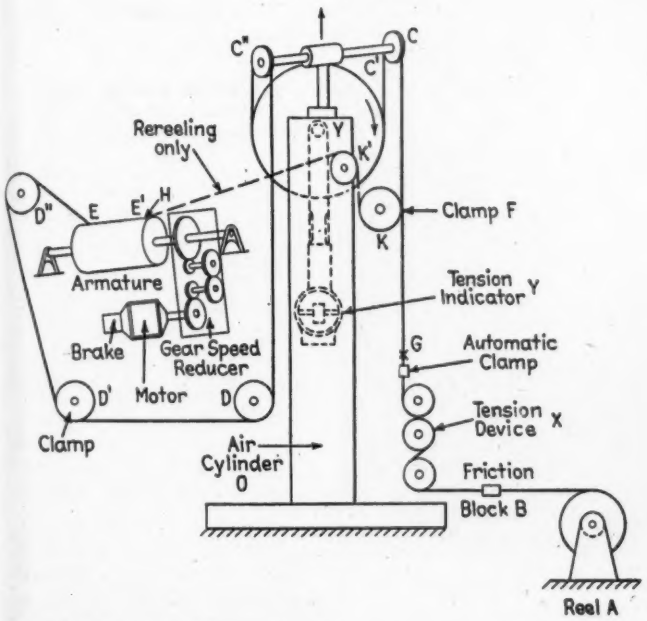


Fig. 3—Schematic diagram showing arrangement of binding wire, pulleys, tension devices and armature drive

The armature is rotated in a clockwise direction, and a "stick" is placed over each armature bar. The wire is then wound around the armature until the opposite end E' is reached. Fig. 5 shows all sticks in position. A brake on the driving motor is set, and clamp "F"

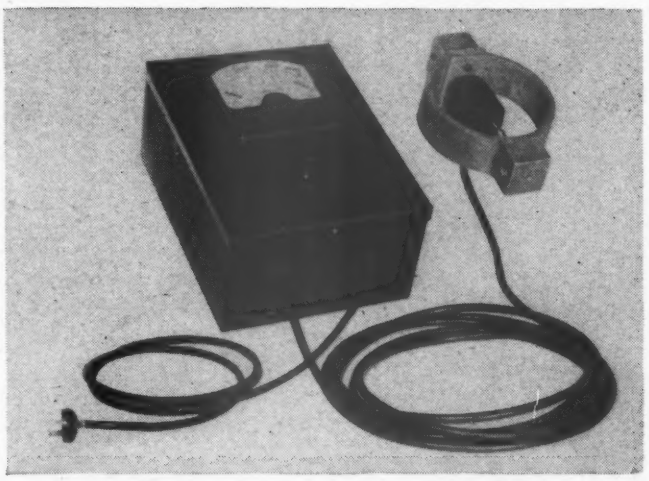


Fig. 4—Tension ring and electric gauge for tension measuring device

(Fig. 3) is applied, so as to retain the tension in the wire. The wire is then cut at point "G," guided around

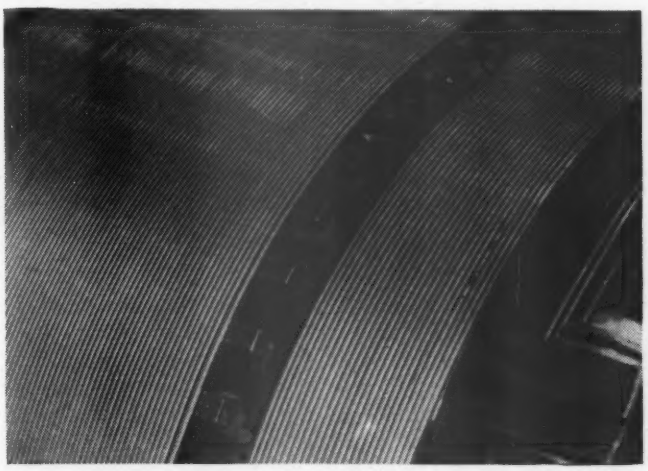


Fig. 5—Temporary binding wire wound over armature "sticks" to apply pressure to armature coils to force them down into the slots

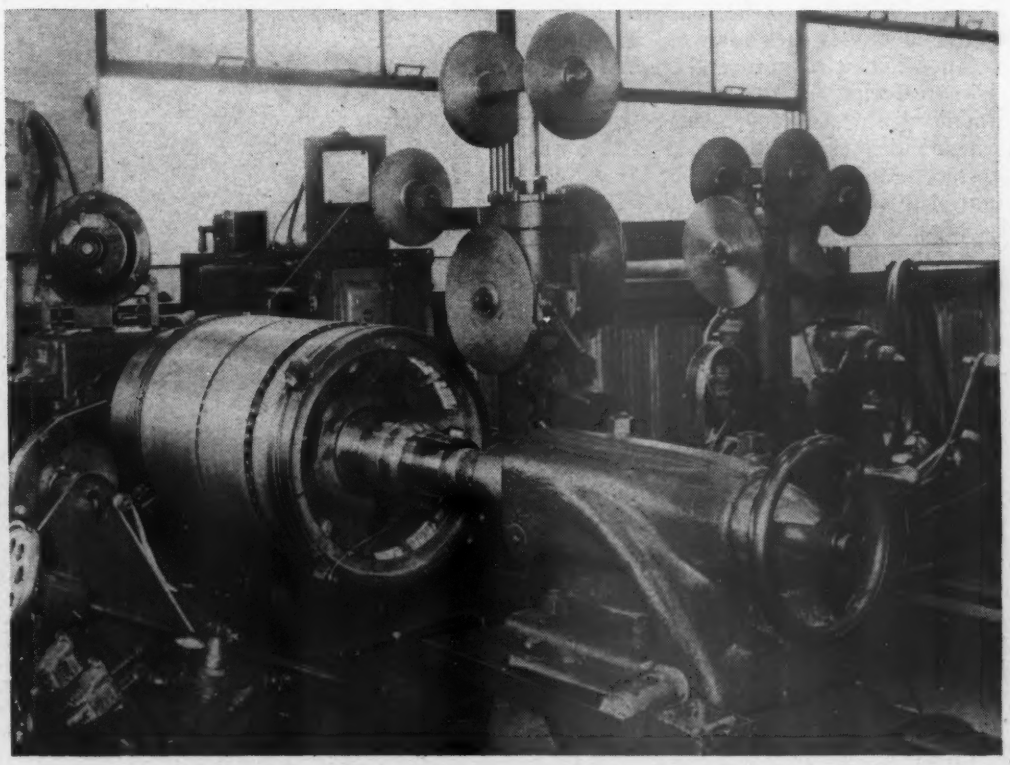


Fig. 6—Binding lathe with re-reeling attachment—View shows temporary binding wire threaded over pulleys and armature ready for re-reeling operation—All pulleys are mounted on the lathe carriage which is moved laterally as wire is re-reeled

Fig. 7—The binding lathe in operation showing the mounting of the lathe carriage

pulleys K and K′ and fastened to the armature at point "H."

Air pressure is then applied to the air cylinder, "O" (Fig. 3), causing pulleys C^1 and C^2, mounted at the end of piston, to rise. As the equipment is designed, 1 in. vertical movement of the pulleys C^1 and C^2 means a 4 in. take up in the binding wire. The tension is again indicated by the meter operated by the electric gauge calibrated in pounds tension. A pressure regulator is installed in the air supply to the cylinder, so that the tension can be adjusted to the correct value.

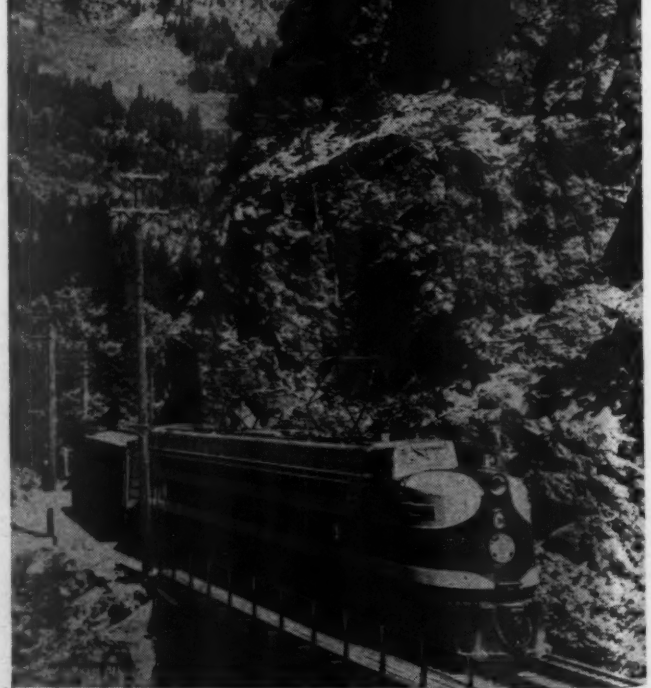
Clamp "F" is then removed and the armature rotated counter-clockwise until end "E" of the wire is reached. This re-reeling of the wire is continued until there is no more upward movement of the air cylinder piston, which indicates that the armature bars are firmly seated at the bottom of the slot. From 4 to 7 passes are required to accomplish this, and 12 to 15 ft. of wire may be taken from the armature.

A binding lathe with such features is shown in Figs. 6, 7, and 8. The lathe is driven by an adjustable-speed d. c. motor with 3 : 1 speed range by field control, with reversing control with heavy duty starting resistor, job and forward, run and forward, stop push button, and dynamic-braking features. The motor is also provided with a disk-type, spring-set brake of sufficient torque to hold the armature from turning due to the tension in the wire.

A total speed range of about 80 ft. per min. during the re-reeling operation is provided. In addition to the 3 : 1 speed by field control, a gear change of 3 : 1 is built into the head of the lathe so that this wire speed range can be secured. All controls are within easy reach of the operator, thus permitting maximum speed of operation.

Several such lathes, covering an armature range of 12 to 60-in. diameter, are being installed at Erie, Pa., plant of the General Electric Company.

* * *



One of the Great Northern's 360-ton, 5,000-hp. single-cab electric locomotives on the railroad's 73-mile electrified Cascade section between Wenatchee and Skykomish, Wash.—The locomotive has a B-D + D-B wheel arrangement with motors on all axles, and will deliver a full 5,000 hp. at the rail at speeds down to 15.75 m.p.h.—There are two locomotives of this type built by the General Electric Company placed in service in 1947

Regular Routine

By Walt Wyre

TURNTABLES are a necessary nuisance at a roundhouse, eternally used, often abused, and likely to break down at the most inopportune time. The turntable at the S. P. & W. roundhouse at Plainville was no exception to the rule, except perhaps more so than usual. Jim Evans was about ready to look over new styles in straight jackets when a new turntable was installed a little over two years ago and turntable troubles ended for a time. He called Ned Sparks, the electrician, into the roundhouse office and said to him, "Sparks, we had lots of trouble with the old turntable and I figure a lot of it was due to lack of proper maintenance."

"That's right," Sparks agreed.

"Well," Evans continued, "I want you to see that the new one is not neglected. I want you to set a certain day of the week to service the turntable and don't let anything keep you from doing it."

"Okay," Sparks replied. "It's a good idea. I figure Wednesday would be as good a day as any. It's usually our lightest day, especially during the fruit and vegetable seasons on the West Coast. It takes about seventy-two hours for the stuff to reach here and they don't usually ship on Sunday."

"All right," Evans nodded, "we'll figure on that then. Every Wednesday afternoon at one o'clock we'll arrange for you to get the turntable for an hour. I'll instruct the first trick hostler and I'll have a notice posted in the turntable cab to that effect."

The arrangement worked nicely for several months. The hostler sometimes grumbled and there was an occasional argument with machinists that wanted spotting done, but the foreman backed up the order and the turntable was serviced regularly every week. Contactors were dressed or replaced as needed, connections checked, brushes and slip rings examined, etc. For almost a year, there wasn't a single locomotive delay caused by turntable trouble.

THEN, in the rush of other work, apparently more important at the time, and because the turntable didn't give any trouble, service became less regular, First, a week was missed, then two weeks, until after about eighteen months turntable maintenance was like a woman's fortieth birthday—something that seldom occurs. Despite lack of attention, the turntable continued to operate.

One day Sparks was walking past the turntable on his way to the roundhouse office when he noticed that the turntable seemed sluggish. Sparks stopped and watched until the table was lined for the outbound lead, then he started towards the cab. John Harris, the roundhouse clerk, came to the door and yelled to Sparks, "Hey, the foreman wants to see you."

"I was watching the turntable," Sparks explained to the foreman. "It seemed sort of sluggish and made a noise like something dragging."

"Good idea," Evans said. "Looking the turntable over, I mean. Soon as you have a little time you had better go over it thoroughly. Right now the division engineer is hollering his head off about some kind of electrical trouble at Sand Springs."

"What kind of trouble?" Sparks asked. "They haven't got anything there except a passenger station. They use an oil engine on the water pump."

"Well, I don't know what the trouble is. The division engineer is in a fizz about something. He's sending a water service truck to take you. Should be here any minute."

"Okay," Sparks said and left the office. He paused a moment when he passed the turntable and started to walk over and examine the electrical equipment when he heard an automobile horn.

Sam Wells, a water service mechanic's helper, was waiting in a light truck. Sparks gathered up some tools and was ready to go.

"What's the trouble at Sand Springs?" Sparks asked when Wells had headed the truck out on the highway.

"Don't know exactly," Wells told him. "Something wrong with the wiring in the agent's house, I think. Did you bring a lunch?"

"No," Sparks replied. "Never thought of it. What time is it?"

"Eleven-ten," Wells replied. "Takes about an hour to drive to Sand Springs and no place to eat when we get there, except a general store that might have canned beans without pork and maybe some bologna."

Wells prediction regarding both the time for the drive and the lunch was fairly accurate. They reached Sand Springs and ate bologna, beans and bread for lunch, then went to the station. The office was closed. There was a sign on the door—"Out to Lunch."

"Guess I had better go to the house and find out what the trouble is," Sparks said.

Ed Clark, the agent, came to the door when Sparks knocked. "Come in," Clark said. "I'll be with you in a moment. Have a seat and wait here where it's warm." The agent went back to finish his lunch.

In about five minutes Clark returned. "All set," he said. "I'm ready if you are." He opened the door and was on his way before Sparks had time to say anything. The agent walked rapidly towards the station with Sparks trying to keep up.

"NOW, what can I do for you?" Clark asked when he reached the station and entered the office.

"I'm Ned Sparks," Sparks told him, "electrician from Plainville."

"Well, why didn't you tell me at the house?" Clark said. "The trouble is over there, a short or something. The refrigerator won't run and the lights get dim. I'll go back with you."

"Wait until I get my tool box," Sparks said.

THE agent's wife was frankly very unhappy about the refrigerator not running. "We only get milk three times a week," she said, "and it sours and we can't keep fresh meat or anything."

"When did you first notice the trouble?" Sparks asked.

"Oh, we have only been here in the house about a week. My husband is new on the job. The refrigerator hasn't run since we moved in."

"I'll look at it," Sparks said.

When the refrigerator was plugged in and the switch turned on, the motor made an effort to start but wouldn't come up to speed. A lamp in the kitchen that was turned on dimmed until the filament was a reddish glow.

"Is it the wiring?" Mrs. Clark asked.

"Could be," Sparks told her, "or it could be the refrigerator stuck."

"The refrigerator was running nicely before we moved it here," the lady said. "It's nearly new," she added.

"Yes, it's a nice refrigerator," Sparks commented, "and I hope there's nothing wrong with it. It's pretty difficult to do much with these sealed units. Wish I had a voltmeter," he added.

After trying unsuccessfully several times to get the refrigerator to start, Sparks asked if there was an open-

"You mean you've found the trouble?"

ing into the attic. Neither the agent nor his wife knew of an opening, but one was found in the back bedroom closet. The electrician borrowed a flashlight and climbed up.

The wiring was apparently in fair condition considering its age. It was a knob and tube job with few tubes. The wires were in most instances knobbed on top of the ceiling joists. Sparks removed tape from a couple of joints. They were tight but had not been soldered.

"Find the trouble?" Mrs. Clark asked when Sparks climbed down from the attic.

"No, nothing definite," Sparks told her. "Could be a loose connection, none of the joints are soldered."

Sparks untaped all of the joints, soldered and retaped them, but didn't find any that appeared to be loose or had been heating. Evidently a poor connection wasn't causing the trouble because the refrigerator still refused to start.

Sparks examined all the connections at the entrance switch and fuse box. They were all good, but just to make certain he cleaned and tightened them all.

"Find anything?" the lady asked anxiously.

"Don't think so," the electrician replied.

Evidently he hadn't. The refrigerator still was on strike.

"Well," Sparks said, "it's either a stuck motor in the refrigerator or trouble in the line between the transformer and the house. Right now it looks like the refrigerator. Wish I had a wattmeter, I could soon tell where the trouble is."

"What are you going to do?" Mrs. Clark asked. "We just must get our refrigerator going."

"I'll look the line over and see if I can see anything from the ground. That's a Rural Electrification Administration line and those boys are pretty cranky about anyone else climbing their poles."

If there was anything wrong with the line, Sparks couldn't see it from the ground. It was typical R. E. A. construction, using a common ground wire for both high and low voltage lines and grounded transformer case.

Sparks went to the passenger station and called the R. E. A. office at Middleton, about 25 miles away. He

asked them to have a service man check the line and connections at the transformer.

"Well, what are you going to do now?" the agent asked.

"If the trouble is not in the line, it's in the refrigerator. I'm pretty certain of that," Sparks replied. "The R. E. A. service man is going to check the line tomorrow. At least the lady in the office said he would and if he doesn't find any trouble, I'll come back and bring a voltmeter. Could be the refrigerator compressor is stuck."

"Anything you can do if it is stuck?" Clark wanted to know.

"Sometimes a capacitor in the starting line will start a stuck motor," Sparks told him. "I believe there is a capacitor in the electric shop at Plainville for a ⅛-horse motor. That's about what the one is in your refrigerator.

SPARKS started to leave the station just as the phone rang. The electrician was opening the outside door when the agent called out, "The foreman says for you to get back to the roundhouse soon as possible. There's something wrong with the turntable."

The electrician gathered up his tools in a hurry and they were on their way towards Plainville.

Wells drove fairly fast and the trip was made in slightly less than an hour. The 5089 was on the turntable when Sparks reached the roundhouse. Is was past quitting time for the first shift men, but most of the second shift was on the job trying to push the locomotive around. The hostler helper was in the turntable cab operating the controller.

Sparks jumped out of the truck and rushed over to the turntable. Obviously, only one of the motors was doing a halfway job of pulling with the other motor acting as a drag, but with about twenty men pushing the table was moving slowly.

Sparks went into the pit to look at the motors. A light haze of smoke was coming out of the motor at the cab end and along with an odor of burning rubber. The electrician dropped flat on his stomach and crawled under the table to look at the other motor. "Hey!" Sparks yelled. "Stop it!"

The hostler moved the controller handle to the "off" position and the table stopped. Evans, breathless from pushing and yelling, rushed around to where Sparks was. "Say, what's the idea?" he asked. "This engine is already late on the call. We've got to get her out."

"Just a second," Sparks replied. "Wait until I release the brake, then maybe you can turn it without burning the motor. If someone will get me a short bar, it will only take a minute."

A machinist helper rushed into the roundhouse and soon returned with a short bar. Sparks pried the magnetic brake loose and placed a block of wood to hold it. "Now, see what it will do."

The one motor still wouldn't quite start the table without help, but after it was started with the help of men pushing, the motor kept it going around.

Sparks started to pull the switch but the foreman stopped him. "There are two more engines to get out and one to get in."

"Where do you want to go?" Sparks asked.

"Line the table for the 5088. She's in stall 14," Evans said.

Sparks moved the controller around. At No. 1 position, there was a slight hum, but the motors made no perceptible effort to turn until the controller was at the fifth notch. Then the motor on the cab end spun the drive wheel. By moving the controller handle back and forth, Sparks managed to get the table moving.

EVANS was standing in the cab door. "What do you think is wrong?" he asked.

"Acts like the resistors might be open, or could be a wire burned off. One motor doesn't seem to be pulling at all."

When the locomotives were turned, Sparks pulled the main switch and went under the table. The resistor for the motor at the cab end was open in two places. The other had at some time been so hot, it was practically falling apart.

"Find anything?" Evans asked when Sparks crawled from the beneath the turntable.

"Plenty! And if there's not a new resistor unit in the storeroom, looks like the turntable will limp around on one motor for awhile. How long will it be before you need to turn another engine?"

"About thirty minutes," Evans told him. "Better not tie the table up yet."

"I was figuring on something to eat. I had a slice of bologna and half a can of beans at noon and nothing since. I'll make a temporary repair so one motor will work, and get a bit to eat."

Evans agreed and Sparks spliced the breaks in the resistor for the cab end motor, using some No. 8 bare copper wire.

When the electrician returned, he went to the storeroom and inquired about a set of resistors. There was none. "Tell the storekeeper to wire for one—no, make it two sets. We should have a spare.

Sparks rushed to the roundhouse and found the turntable very busy. A machinist was putting in a set of drawbars and needed the tank shoved up. Another was running over the valves of a locomotive and had to have the engine moved. Two locomotives to go in the house and one to get out. Sparks waited nearly two hours before he could resume work on the turntable.

The main cause of the trouble was a loose wire to the magnetic brake on the motor opposite the cab. The brake had failed to release, thus overloading the motors, causing the resistors to burn. A wire to one set of slip ring brushes had been so hot the solder melted out of the connection.

Evans had in the meantime gone home and Bob Parker, the night foreman, was on the job. The electrician spent about thirty minutes explaining to Parker what was wrong with the turntable, then by that time there was another engine to get out.

It was almost midnight when Sparks finished patching up the electrical equipment. One motor was working okay. The other helped when the controller handle was all the way around, causing the table to turn like a frog walking.

NEXT morning after Sparks had finished doing jobs that were pushing, he went to the storeroom to see if the resistors had been ordered and received a tremendous surprise. "Sure, we've got them ordered, and they'll be shipped express today—just got a wire," the storekeeper said.

"What!" Sparks almost fell over.

"Yeah, we're on the job! the storekeeper admitted. "Besides, I understand the electrical engineer checked up not long ago and had the system store department put in a stock of repair parts for turntables."

That afternoon Sparks was in the electric shop repairing extension cords when the roundhouse clerk entered, evidently in a rush. "The division engineer wants to talk to you on the 'phone," the clerk said. "Sounded like he was all out of humor."

Sparks hurried to the office and picked up the phone.

"The men from the R. E. A. went to Sand Springs and took the meter out of the agent's house," the division engineer said. "Now they haven't got any lights. The

agent is threatening to walk off the job if we don't get the wiring fixed—but quick!" he added.

"Why did they take the meter out?" Sparks asked.

"That's what I want you to find out. The water service truck is on the way to pick you up, and I want the lights fixed tonight."

"But—" Sparks started to reply, but a click in the receiver told him that the division engineer had hung up.

"It was after three o'clock when the water service car reached Sand Springs. Sparks went to the station to talk to the agent.

"The R. E. A. men said the polarizing is shorted or something," the agent explained. "Anyway, they stuck a little light in each of the sockets and said something about the polarizing being wrong."

"If you'll call the R. E. A. office, I'll talk to them," Sparks suggested.

After considerable argument, the R. E. A. supervisor agreed to send a service man to Sand Springs, but warned Sparks that if the trouble was in the house wiring, as the R. E. A. lineman had insisted, the railroad would have to pay for the call.

"If there's a short in the house wiring, I'll pay for the call myself," Sparks snapped. "It may be that some of the sockets are not correctly polarized, but that wouldn't cause any trouble."

AFTER Sparks hung up the receiver, he began to wish he hadn't said quite so much. He decided to do a little testing before the R. E. A. man got there. He went to the house, put wire jumpers across the meter clips, and tested the voltage with everything in the house turned off. The voltmeter showed 120 volts. Then when he started turning on lights, the voltage dropped until when lamps totaling 400 watts were turned on, the voltage dropped below 100. When the refrigerator was turned on, the voltage dropped below 70.

"Do you have an electric iron?" he asked Mrs. Clark.

"Yes, but I haven't used it since we came here."

"Well, let me have it; I want to try something."

The electrician took the electric iron out to the meter box, removed the jumpers from the meter clips and connected the iron to the service line side. The voltage dropped to less than 65 and returned to 120 when the iron was disconnected.

"Phew!" Sparks set the voltmeter down and rubbed his forehead. "Now, I'm satisfied."

"You mean you've found the trouble?" the water service man who was watching asked.

"No, not exactly, but I know it's not in the house wiring."

While Sparks was talking, the R. E. A. service truck turned the corner towards the house. Sparks grabbed the voltmeter, electric iron, and jumper wires and carried them in the house. When he returned, the truck had stopped and two men were getting out. One of them was carrying a portable test set that consisted of a set of radio batteries of 220 volts, a neon test light, and a voltmeter.

"Well, did you clear up the short in the wiring?" one of the men asked.

"There wasn't any short to clear up," Sparks said.

"Oh, yes," the R. E. A. man said, "and the polarity is wrong on half the sockets."

"We won't argue about that. I'll switch the wires on the sockets and buy you a drink if you show me that the wiring is shorted. You've got trouble either in the line or transformer."

"Oh, no! We've been over the line. It's all okay." The lineman was connecting his test set while he talked. "See this?" The voltmeter showed 120 volts on the line. When the switch to the neon light was closed, it glowed a very dull red. "That's not so bad," the lineman admitted, "but when the lights are turned on, the voltage drops, and when the refrigerator is turned on, the voltage goes way down."

"I'll say it does," Sparks agreed. "Now, if you'll just wait a couple of minutes, I'll show you something."

SPARKS went into the house and returned a moment later carrying his voltmeter, and the electric iron. He connected the iron to the service line with the house service switch open.

The R. E. A. service man looked, rubbed his eyes and looked again. "Well, that beats me!" he acknowledged. "Come on, Bill, let's get our hooks on and start hiking poles," he said to his companion.

The lineman found the trouble on the transformer pole. When the transformer was installed, someone had used a clamp connector that was too large on the ground wire. In time, it had come loose and the wire had burned until there was for all practical purposes no connection at all causing what was actually a circuit of one wire, and the earth to the house from the nearest transformer that was properly connected to the ground wire. The next closest transformer was over a quarter of a mile away which was too far to carry any amount of current at 110 volts, using the earth as one side of the line.

When the new connector was put on the line, the lights in the house were okay and the refrigerator started and ran nicely.

"Now, if you'll show me which sockets are not polarized correctly, I'll change them," Sparks suggested.

"Oh, that won't make any difference," the R. E. A. man replied. "But, I'll show you and you can change them when you feel like it, and I'll appreciate it if you don't say too much about the bad connection at the transformer."

"I have forgotten all about it," Sparks grinned. "The man that never made a mistake, never does anything."

Next day, the resistors arrived for the turntable motors. Sparks installed a new one for the motor on the end opposite the cab. When he had finished, Evans asked the electrician to come to the office.

"You know," Evans began, "most of the trouble we have had with the turntable has been because of lack of maintenance."

"That's right," Sparks agreed.

"Well, starting now, I want you to service the turntable regularly every week. I'll arrange for you to get the table at one o'clock every Wednesday afternoon."

"Same old routine," Sparks muttered under his breath.

"What?" Evans asked.

"I said it's a good idea," Sparks replied.

Color and Light for the Shop

(*Continued from page 31*)

wise confused mass of overhead cranes, beams, and machines in a railway repair plant. The eye is rested by complementary colors while, at the same time, operating portions of machines are brought sharply to attention. Contrasts are drawn sharply between the material being worked upon and the machines. The results are lower fatigue, more accuracy, better employee morale, and higher production. Accident rates have decreased and absenteeism has dropped.

Increasing Motor Capacity

We are expecting to install additional machines which may be driven from the existing line shaft. The present motor capacity will not be sufficient to carry the additional load. In order to save the expense of installing a new line shaft, we have thought of replacing the existing motor with a larger one on the same line shaft. What is recommended in this case?

Individual Drive Is Indicated

Unless there is some particular reason for driving additional machines from the line shaft, it seems that individually motorized machines would be more practical. Line shafts are usually used for one of two reasons, or both: to reduce installation costs, or, when electric power is not available and steam or internal combustion engines are used to provide power. In this instance electricity is obviously available, thus eliminating one of the reasons for belting to a line shaft. If installation of additional machines makes it necessary to purchase a larger motor, it is doubtful if the initial cost will be very much, if any, less than using individual motors.

The present tendency in most shops is to eliminate line shafts entirely in favor of individually motorized machines. Maintenance usually costs less, mainly because of belt expense; if a crane is used, belts and shafting are often in the way, and despite every precaution and well guarded belts, they are somewhat more dangerous than individually motorized machines. Another reason in favor of individual motors: when all machines are driven from one motor, in case of breakdown, all machines are out of service while repairs are being made.

There are instances where two motors are used to drive a line shaft but this is more of an emergency makeshift than practical for a permanent installation. It is very difficult to distribute the load between two or more motors belted to a shaft so that each will carry its proper share of the load.

W. L. COTTON

Eight Reasons for Using Individual Drive

Whether or not you can install a motor with more horsepower on your existing line shaft is a question that can only be answered by having complete information concerning the application and the mechanical design of the equipment involved. Generally speaking, such a decision would depend upon the diameter of the shaft and the number and type of machines that would be running simultaneously from the power supplied by the shaft.

However, you may be approaching the point where it would be feasible to consider individual motor drives for each machine rather than line-shaft operation. Some of the conditions warranting such a change would be:

1—Where machines are isolated, requiring long lines of shafting to combine with other groups, so that the cost of the transmission more than offsets the extra expense of individual motors.

2—Where the roof construction will not safely support heavier line shafting.

3—Where many of the machines on the line shaft operate intermittently or at infrequent intervals.

4—Where considerable overtime work involving only a few machines is carried on.

Can you answer the following questions? Answers should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York 7.

On dismantling a 20 hp., squirrel cage, three-phase induction motor for the annual overhaul, we discovered that several of the rotor bars and end rings were broken. The motor had been operating satisfactorily. What caused these breakages and how can we stop their recurrence in the future?

5—Where length of shafting causes large transmission losses.

6—Where interruptions due to breakdowns are costly. It would be advantageous to operate machines independently from this standpoint.

7—Where arranging machines in line shaft drive does not allow a logical arrangement of machines for production purposes.

8—Where more precise speed maintenance is required to produce more uniform work (such as grinding).

In summary, we think that you will arrive at the best decision by consulting directly with representatives of one or more large electrical manufacturers. They will make a study of your application and advise you as to whether it will be feasible to add more horsepower to your line shaft or change over to individual motor drives.

J. H. LOTRIDGE
Motor Divisions
General Electric Company

Motors Must Have Same Slip

Local conditions and what is available or may be conveniently purchased will indicate the best solution in each case.

It is possible to drive the additional load with the help of an additional motor connected by belt drive to the same line shaft. The most important factor in laying out such a drive is to see that the operating characteristics of the two motors are the same, that is, each has the same per cent slip at the same per cent of full load. It is not necessary that the two motors be of the same horsepower rating. Motors of different makes, but of the same horsepower rating and full load speed, usually have different speed-torque characteristics. Even with two identical motors of the same manufacture, it is always safer to check the distribution of load over the loading range.

Inasmuch as a belt drive seems to be contemplated, it would be necessary to check the sizes of driving, and driven pulleys to give the same line shaft speed at a given loading. The tension of the belts should also be adjusted to secure approximately the same slippage on the two drives. In making the final readjustments of load distribution in proportion to the motor ratings, the diameter of pulleys may be slightly varied to secure the proper share of loading of a motor for a given total load. In general, to cause a motor to take less load, either the diameter of the driving pulley must be decreased or the diameter of the driven pulley must be increased. Another method would be to increase the belt speed of the underloaded motor. Where a slight enlargement of pulley diameter is required and a pulley in that size is not available, a relatively permanent job may be done by gluing tough cloth or leather belting to the pulley face.

It may, however, be possible to avoid this type of drive if individual drive for some of the existing machines or

the machines to be added presents better advantages which may outweigh the apparent economy of the two-motor drive. This method would again make one-motor operation of the line shaft possible.

Then again, when the second motor does not lend itself to satisfactory parallel drive, it may be advisable to cut the line shaft in two at a point corresponding to the relative ratings of the two motors and have each motor drive one section of the line shaft.

R. G. CAZANJIAN

Line Shaft Can Be Divided

No positive recommendation is possible without first forming an opinion, which is precluded on account of lack of pertinent information.

It is very likely that mere substitution of motors cannot be made as easily as may at first appear, because either the size of the motor must increase for the same r.p.m., or the speed of the motor must increase to obtain higher horsepower.

If a motor with the same speed can be found, it will not fit on the old foundation, and will require wider belts for the main drive to transmit more power at near the same belt speed.

If a motor with a higher speed is obtained, a larger pulley will be required on the line shaft to keep the line shaft r.p.m. to the speed already fixed by the requirements of the present driven machinery, assuming that the belt speed is within the maximum speed allowed for belts. This is assuming more than can be expected, if there is a large increase in motor r.p.m.

An intermediate drive shaft could be used, with a V-belt drive, or a reduction-gear on the motor, and a belt between the intermediate shaft and the line shaft.

So it begins to appear that a new main drive may cost as much as a new line shaft, with few advantages gained and some disadvantages incurred, such as the old line shaft being too light for the increased load, its bearings too small to run cool, its hangers and the building structure supporting them being overloaded.

However, there are some alternative methods, one of which may be chosen, depending on shop requirements.

First, it is necessary to decide upon the ideal shop floor plan for maximum output at minimum cost, even if such a plan requires relocation of most of the present machinery. Then compromise for each machine, present and new, to determine if the changes indicated will pay through decreased costs, or increased production, whichever is deemed most important.

It is quite likely that the best location for several machines will take them away from the present line shaft, so that motorizing these machines will furnish the increased power requirements.

Then it is necessary to decide if alternate use of some machines can be obtained by study of production requirements, and then use care in planning the daily work. Most railroad shops are used for repairs only, with no need for all machines being in use at the same time, so a choice of the most urgent needs can always be made. Or some of the machines can be used on the day shift, while others are used on the night shifts.

To use shop terms, "favor the hot work, and use the dead work to keep the boys busy."

But probably the most practical plan is to divide the present line shaft into two sections, by disconnecting a present shaft coupling at a suitable location to favor the ideal shop plan. Then a second motor will furnish power for one section of shaft, while the present motor furnishes power to the other section of shaft,—without any changes at all, for that section.

The shafts will need some lateral separation to avoid interference at the disconnected coupling, but that is easily obtained by readjustment of the shaft thrust collars. Leaving the coupling-halfs on the shaft will allow reconnecting the coupling in the event of a motor failure, so either motor will drive the entire line shaft, allowing a choice of urgently needed machines, while motor repairs are being made. Or if shop demands are seasonable, both motors can be used during rush seasons, with only one in use during dull seasons, resulting in a decided savings in power costs, due to reduced "standby demand."

If the second motor is exactly similar to the present motor, other advantages are obtained. If necessary, in case of failure, the motors can be transposed. Also only one set of spare parts is required, and interchange of parts is possible for making at least one motor always available.

L. SKELLENGER,
Tacoma, Wash.

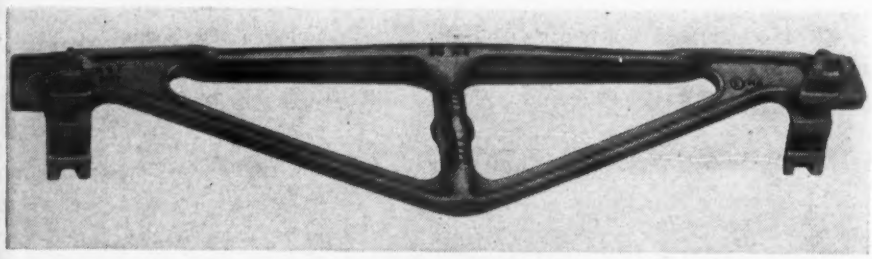
* * *

Passengers getting off a train at the Valparaiso station, coastal terminus of the electrified section of the Chilean State Railways—This system has recently placed an order with Electrical Export Corporation for four express passenger and eight switcher locomotives, as well as additional equipment for four substations and two switching stations—The line was electrified in 1924, the equipment being supplied by the Westinghouse Electric Corporation

NEW DEVICES

One-Piece Brake Beam

One-piece cast-steel brake beam for all freight-car trucks with unit-type brake-beam guide brackets has recently been developed by the American Steel Foundries, 410 North Michigan avenue, Chicago 11. The one-piece steel casting includes brake heads, fulcrum, and end supports as integral parts of the permanently rigid truss structure. There is nothing to shake loose, and the alignment of levers and rods is preserved. The control and maintenance of piston travel is furthered by the structural stiffness of this beam.



A. S. F. cast-steel unit brake beam

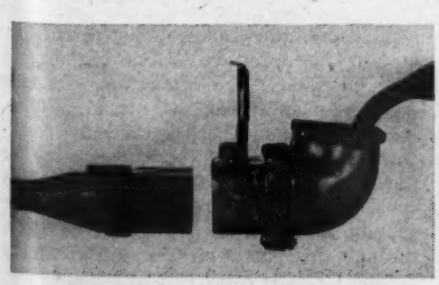
This brake beam needs no bias fulcrum slot. The load-carrying beam members parallel the rail. Brake-lever force is delivered in line with the plane of the truss. Standard levers can be used both on A. A. R. and long-spring-travel trucks. The end supports and brake heads are set at an angle with the truss so that applied braking force is along a radial line from the center of the truck axle to prevent eccentric loading.

The one-piece construction of this cast-steel unit brake beam permits more efficient metal distribution for greater strength with lighter weight. The beam weighs 115 lb. Static tests show a deflection of .055 in. under a 20,000-lb. load, and a set of .001 in. at 32,000 lb. Fatigue and service tests are said to have demonstrated its durability.

Communication Circuit Connector

The Mines Equipment Company, Dept. 13, 4215 Clayton avenue, St. Louis 10, Mo., is producing plugs and receptacles for inter-car communication circuit connections. They are of molded Neoprene construction and meet the specifications prepared by the Electrical Section, Mechanical Division, A. A. R.

All conductor to contact connections in both plugs and receptacles are soldered at the factory and then firmly embedded in molded rubber, making a waterproof assembly. Contacts and contact joints, being securely held in resilient rubber, effectively withstand train vibration. The rubber jackets used are Neoprene which is highly resistant to abrasion, oil or grease and heat or cold. They will not harden or crack in sub-zero weather.



The plug and receptacle each have 14 contacts and are mounted over the vestibule in the cars

Draft Gear For Diesel Locomotives

A friction draft gear, recently developed and designated Class A-121 by W. H. Miner, Inc., Chicago, is designed for effective service in cushioning longitudinal train shocks when used on Diesel locomotives, either freight or passenger-type. This gear is readily applicable to the special yoke and draft gear conditions which prevail on existing Diesel locomotive equipment. It is 24¾ in. wide and has a yoke opening 12⅝ in. high by 16¾ in. long. The lug spacing is 13¾ in.

Miner friction draft gear for Diesel locomotives

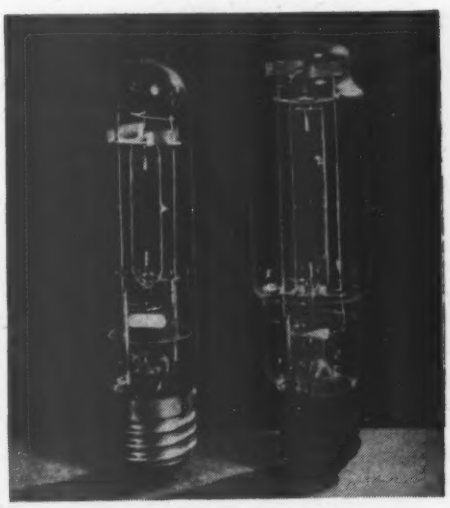
The A-121 draft gear provides ample permanent capacity and permits smooth action between the power unit and the train. The gear is furnished as a completely assembled unit (temporarily precompressed to a dimension less than the pocket length to permit easy installation in the yoke and draft-gear pocket).

Great sturdiness of column and resistance to wear in the friction parts are said to be built into this draft gear as a result of modern innovations in metallurgical practice.

Mercury Lamp For Universal Burning

An A-H5 mercury lamp of improved design which may be used for all general lighting applications in which mercury lamps are particularly desirable, has been announced by the lamp department of the General Electric Company, Nela Park, Cleveland, Ohio. The lamp replaces both the former A-H5 and C-H5 lamps at no change in price.

Like the former mercury lamps, the lamp is used with a transformer. However, it may be used in all presently existing equipment as there is no change required in auxiliary or fixture dimensions. When used for black light applications, a filter, usually black glass, must be used.



The older type A-H5 lamp is shown at the left, the new one at the right

The A-H5 mercury lamp looks slightly different from the former A-H5 lamp because of changes in the outer bulb structure. The inner arc tube also has been redesigned to produce greater efficiency, longer life and to permit burning in any position.

The lamp is rated at 250 watts and has a maximum outside length of 8 in. The larger outer envelope of special heat resistant glass contributes to a longer life than the lamps it replaces.

Under the same burning conditions, the lamp has 2½ times the life of the present A-H5 and 25 per cent more than the C-H5. It produces 45 lumens as contrasted to 40 lumens-per-watt for the older lamps. It can be burned in any position with good life expectancy. It has a mechanically attached base, graphite coated. The coating is a distinct advantage, particularly for black light applications as it prevents

"freezing" in the sockets. A possible use of black light in railroad application is for outdoor signs.

Stainless Steel Gas-Welding Flux

A flux for the oxyacetylene welding of stainless steels and high-chromium-bearing alloys, designated as Airco Formula No. 34, is made by the Air Reduction Sales Company, 60 East 42nd Street, New York 17. The flux is compounded to dissolve the chromium oxides encountered in welding stainless steel and other high-chromium-bearing alloys. Application by painting the immediate and surrounding surfaces to be welded protects the molten metal from the air, thus preventing oxidation.

Electric Contouring Device

An electric contouring device to duplicate work accurately, automatically, and quickly, and which can be installed on any LeBlond Regal lathe in 10 minutes, is available from the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. The device can be plugged into the nearest light socket, and will perform accurately within .0015 in. to .002 in. the complete range of duplicating operations, such as straight facing and turning, making tapers of any kind, shoulders, necking, concave and convex surfaces and spherical surfaces. The duplicator is adaptable to duplicating work between centers or profile facing.

With the duplicator slide which swivels on either side of the center line of the cross-slide, the tool may be fed either toward the headstock or the tailstock. Constant distance between the tool and the template is maintained because the template bar is a part of the tool slide and moves in and out with it. The diameter is thus controlled by the regular cross feed screw.

Three electric push buttons for in, out, and automatic cycle simplify operation. Since the duplicator may be quickly installed or removed, it does not interfere with the normal operation of the lathe. The slide on which the duplicator is mounted is interchangeable with the standard Regal top slide; no machining, drilling, or fitting is required.

Agitating Cleaning Machine

The Magnus Aja-Dip cleaning machine augments the action of its cleaning fluid by mechanically raising and lowering the platform containing the dirty parts 60 times a minute through the solution with an 8-in. vertical stroke. This imparts a shearing action to the cleaning which helps to cut the dirt. The vertical and fast motion of the work in the cleaning solution forces the cleaning fluid through interstices and recessed portions of the work, bringing new active solution into contact with the dirt with each stroke.

Cleaning with these machines is fully automatic, requiring labor only for loading and unloading. The operator is freed for other duties while the Aja-Dip does the cleaning. It may be used with either hot or cold cleaning solutions, and if heated, the heat may be supplied by steam, electricity, oil, gas or kerosene. The outward appearance is streamline with a grouped control and instrument panel. The drive mechanism is located entirely in the front of the machine for easier servicing.

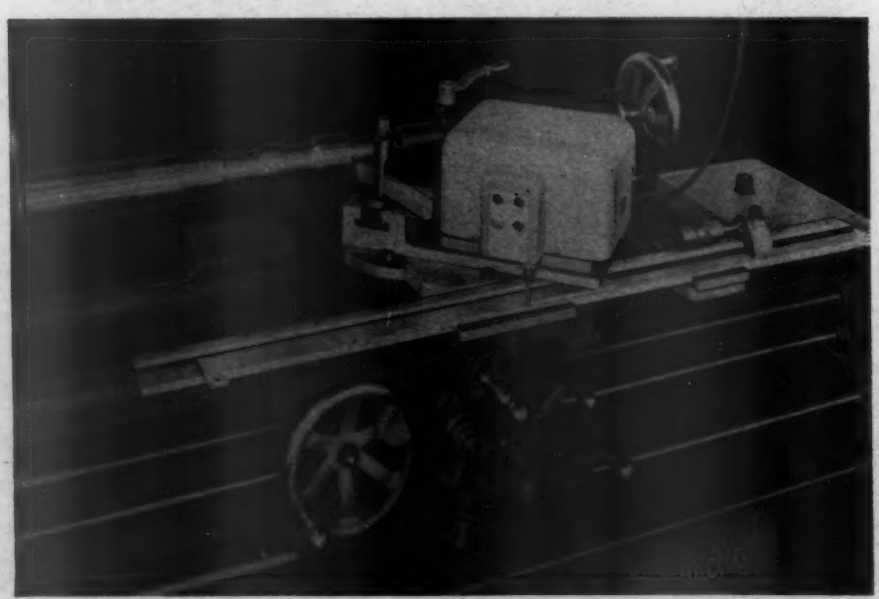
Aja-Dip cleaning machines are made in 13 sizes and types ranging from the midget type handling a few pounds of work to the jumbo type handling 2,200 lb. at a time. They are available from the Equipment Division, Department RME, Magnus Chemical Company, Inc., Garwood, N. J.

The Magnus Aja-Dip Cleaning Machine

Sand Trap

A sand trap featuring automatic cleanout of the sand delivery pipe, simplicity of operation and ease of maintenance has been developed by the Morris B. Brewster Company, 8 South Michigan avenue, Chicago 3. The trap requires but one air line and contains no springs, relay valves or valves which require grinding of the seats. Operation is independent of variations in air pressure, full measure of sand being delivered to all points with a locomotive air pressure anywhere between 90 and 140 lb. per sq. in.

Turning the valve in the cap begins the combined cleaning and sanding cycle. Air at full line pressure enters chamber *A* through the air line connection. Leading from the chamber are two openings. One, which is quite small, leads vertically downward to the nozzle through which the air flows to move the sand. The other is considerably larger, and, virtually the entire amount of air leaving chamber *A* flows through this port which runs horizontally around the sand entry pipe into chamber *B*. This flow of air into and through chamber *B* continues for a brief interval until the



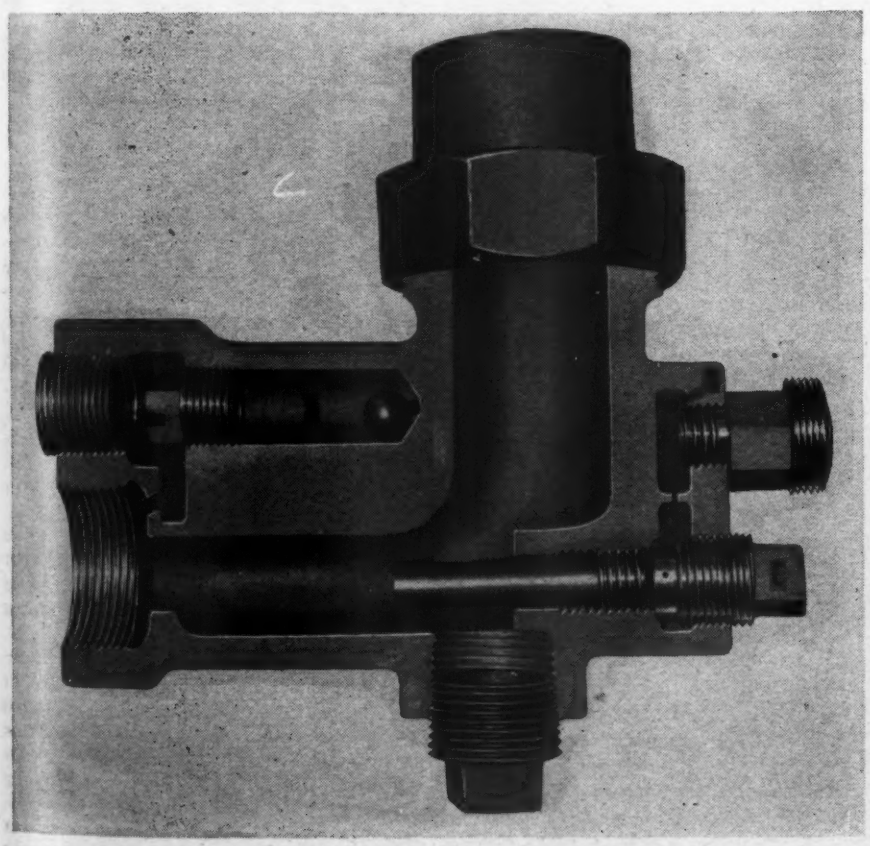
Front of the LeBlond electric contouring device showing the template, template bar, stylus pointer, micrometer adjustment, bed bracket, push-button control and finished stock between centers

velocity forces the steel ball against the opening in the threaded discharge member. It is this cleanout air which flows from the time the cab valve is opened until the steel ball shuts off the exit that provides the automatic cleaning action.

As the exit for air entering the large port is now closed, the air under pressure in chamber *A* flows down through the smaller vertical port through the opening in the throttle plug, *C*, and on into the nozzle. This air flowing through the nozzle moves the sand which has entered the trap through the large main opening from the top and is lying at an angle across the discharge side of the nozzle.

The flow of sand in pounds per minute is set at the terminal and is beyond the control of the engineman. It can be varied from a minimum of ¾ lb. per min. to a maximum of 6 to 10 lb. per min. The threaded nozzle has a slot for adjustment by a screw driver. Turning the nozzle further in reduces the flow of sand as there is less sand ahead of the flow of air. One complete turn varies the sand flow approximately 1 lb. per min. The throttle plug *C*, is a separate piece from the nozzle. It is threaded for easy removal when adjustment of the nozzle is desired and to permit it to be secured tightly against its seat to restrain the air to flow from chamber *A* to the nozzle through the small port in the plug. Adjustments to the flow of sand may be made without disconnecting the air line.

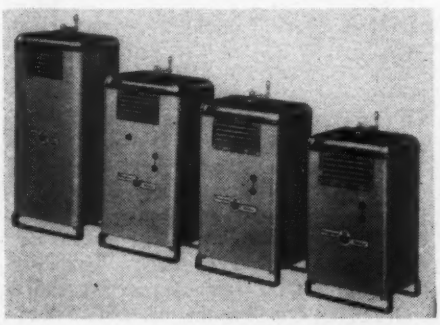
The joint at the top of the main pipe where the sand enters the trap is vee-shaped for a moisture seal and to help prevent starting the coupling nut cross threaded. Ports within the trap through which sand flows are designed as far as possible to prevent abrasive wear. Sections are constructed to permit some sand to remain in pockets so that the sand which is traveling at high velocity will rub on sand, rather than on the metal. The Brewster sand trap is manufactured with either a horizontal or an angle outlet, and with either a union or a bolted flange.



The Brewster sand trap features automatic cleanout of the sand delivery pipe

Low Voltage Welder

A new and smaller Flexarc industrial line of a.c. welders is being made by the Westinghouse Electric Corporation. A compact, streamline case, housing a reactor and transformer having high permeability Hipersil steel cores, is a feature of the transformers. Their open-circuit voltage is 65, and the manufacturer states they have high arc stability in the lowest as well as the highest current ranges. The five output ratings are 200, 300, 400, 500, and a duplex 300/600 amp.



The welders are available in four ratings

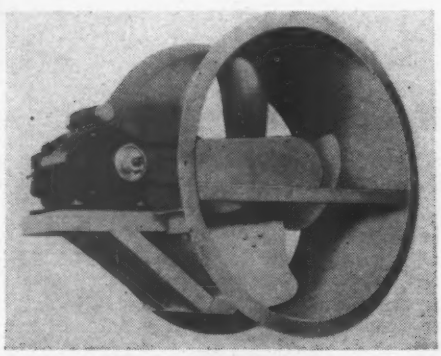
Built-in, low voltage control, it is said, assures high operating efficiency in the low current range, and built-in capacitors assure a high power factor.

Natural ventilation and a movable core reactor operated by single ball crank current adjusting mechanism are used to guarantee minimum maintenance and attention. To reduce overall size and maintain uniformly high operating efficiency, fan cooling is employed in the 500 amp. ratings.

Spray Booth Fans

Booster fans, for use in paint spray booths and where there is excessive heat or fumes, are now being made in five sizes by the Chelsea Fan & Blower Co., 1200 Grove street, Irvington, N. J. Construction is rugged and operation is quiet for units handling large volumes of air. Fan shafts and motors are ball-bearing mounted, and the fans are designed for either vertical or horizontal operation. Blades are made of non-ferrous metal.

All ratings are certified by the Propeller Fan Manufacturers Association. The five types range in capacity from 2,000 to 9,500 cu. ft. per min. with propeller diameters from 16 to 30 in. The motors used are ¼, ⅓ and ½ hp.

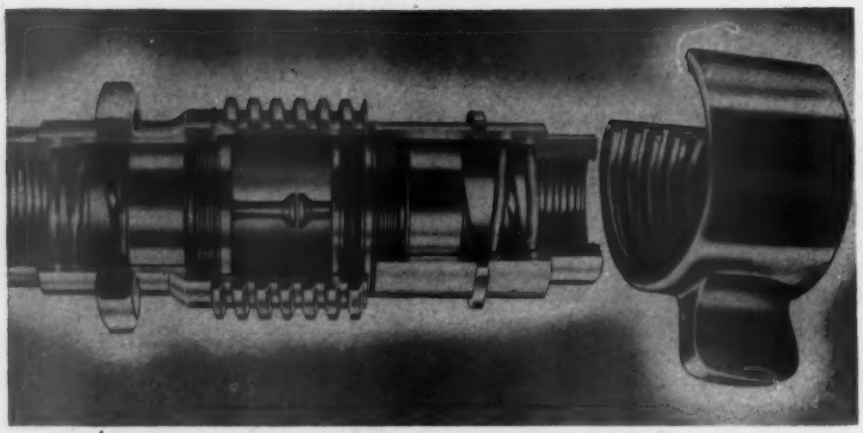


The fans are belt-driven with the motors outside the air stream

Quick-Disconnect Coupling

A quick-disconnect coupling developed for use on Freon refrigeration units is being marketed by the Paxton-Mitchell Company, Dept. Q-4, Twenty-seventh and Martha streets, Omaha 5, Neb. Originally designed to provide a rapid means of changing air-conditioning units on railroad passenger cars, the product is also applicable to other types of service, such as air, gas and hydraulic systems.

The coupling is fabricated from extruded brass bar stock to eliminate porosity which might result in leaks. Fast Acme threads permit rapid opening of the union joint. The dual valves are self closing as the union joint is broken and guided to prevent cocking in the guides. The unit is designed so as to relieve the pressure between the valves while they are being disconnected and to trap only a minimum of air between the valve seats when making up the union. The valve seats are of removable Freon-resistant Neoprene.



Rapid-disconnect coupling made by the Paxton-Mitchell Company for air conditioning units and other uses

This coupling is made in ½-in., ¾-in., 1-in., and 1½-in. sizes, all permitting in excess of 100 per cent of pipe capacity for equivalent pipe sizes. A tight seal may be made under the highest pressures encountered in Freon refrigeration systems and rapid change out of refrigeration units accomplished without the necessity of pumping down the unit.

Heavy-Duty Floor

A heavy-duty floor for use in the transportation field is made by the Industrial Division of the Armstrong Cork Company, Lancaster, Pa. Trade-marked Acolon, it

Acolon flooring material is available in seven colors in either ribbed or plain surface design

is a wear-resistant synthetic polymer calendered onto a burlap backing. Properties of the product include a non-skid surface, dimensional stability, a wide color range and easy installation.

Seven color choices are available, most of them in both ribbed and plain styles. The ribbed patterns are offered in rolls 60 in. wide, .140 in. thick, and may be obtained in black, green, blue, brown or terra cotta. Plain colors come in rolls 72 in. wide and .125 in. thick in black, green, blue, brown, white and red.

For installation, the burlap backing helps give adhesion to most transportation floor surfaces and the material can be cut so that a clean, sharp edge results. Flexibility allows flashing up sides, or covering short radii without cracking the material. Seams can be cut flush because no allowance need be made for growing or drawing.

The Hulson Draft Gear

The Hulson draft gear, referred to briefly in a recent *Railway Mechanical Engineer* news article, is unique in that (1) it is the first draft gear made entirely of fabricated and welded steel instead of cast steel; and (2) it is the lightest draft gear yet certified by the Association of American Railroads. The gear is being manufactured by the A. O. Smith Corporation, Railroad Products Division, Milwaukee, Wis., and marketed by the Hulson Company, Chicago.

As assembled, ready for installation on any freight car or locomotive tender, the gear weighs 202 lb. or a total of 404 lb. per car set. With an average weight saving of 249 lb. per car set the Hudson gear will affect a weight saving in a 100 car freight train of approximately 25,000 lb.

Out of 50 Hulson draft gears made at the A. O. Smith plant, six were selected at random by the A. A. R. and put through prescribed test in the A. A. R. testing facilities at Purdue University. The gears passed the test successfully and the A. A. R. Draft Gear Committee granted a certificate of approval.

This new draft has several interesting features aside from lightness. Because it is fabricated entirely from rolled steel in accordance with a tested design, the gear tends to be free from hidden defects. Automatic welding equipment assures exceptionally uniform welds. The retainer bolt, which holds the gear together is especially designed and forged to withstand shock. The plunger is hot formed instead of forged or cast and has a bearing surface which requires no machining.

As shown in the illustration, parts included in the final assembly of the Hulson draft gear include the housing, one inner and one outer spring, a spacer, an equalizer, four shoes, a plunger and a retainer bolt and nut. The springs, spacer, equalizer and shoes are purchased from outside sources. The housing is fabricated at the A. O. Smith plant where the plunger is also made in a 9,000-ton mechanical press which transforms a piece of bar steel into the final form in one pass.

The gear is worked up in the desired capacity in a 1,500-ton press equipped with special gears which operates at the rate of 48 times a minute. The shoes rub against the housing and develop enough contact for the required capacity without any machining operation being required.

Disassembled and assembled views of a Hulson Type 202 draft gear

Webbed Seat Base

Thermo Seal webbing is a resilient seating support designed to give passengers increased comfort and to allow the use of thin, light-weight cushions. The webbing allows elasticity to be built into the seating structure, thereby eliminating the necessity for any type of metal spring. The desired resiliency, being integral, results in the saving of weight, space and labor as the cushions rest directly on the webbing.

Thermo Seal webbing applied to a seat structure gives resiliency and light weight

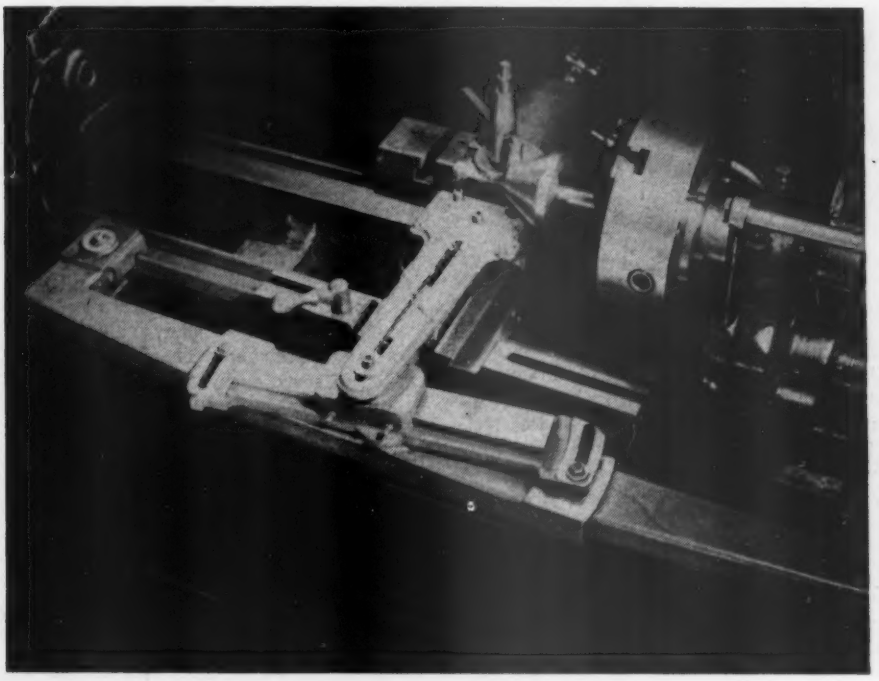
The webbing is said to be resistant to flame, mold, rot and to most chemical solvents. Physical tests guarantee ultimate tensile strength of 3,000 lb. per sq. in. at 300 per cent elongation. The material is welded together, no stitching or rivets being used. For simplicity of application metal fittings can be made an integral part of the webbing.

It is available in standard widths of 1, 1¼, and 2 in., in thicknesses of .062, .080 and .120 in., and in any length desired, from the Artisan Engineering and Manufacturing Company, 466 South Robertson boulevard, Los Angeles 36, Calif.

Taper Attachment

A taper attachment for lathes is manufactured in two sizes, 34 in. and 40 in. between arms, and for vee or flat ways, by the Master Taper Company, 126 North Clinton street, Chicago 6. It can be furnished for all lathes with a 13-in. to a 26-in. swing.

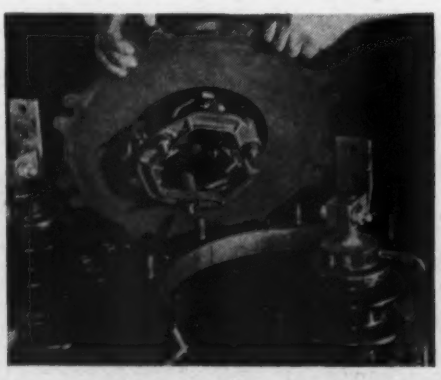
The construction is steel and designed for heavy-duty service. Tapers up to 4 in. per ft. or 20 deg. maximum in either direction and 16 in. in length at one setting can be handled. The swivel bar has V-ways with the ends graduated in degrees at one end and in inches per foot at the other. The sliding fixture has a long bearing on the swivel bar with gibs to compensate for continuous usage. The attachment is installed by drilling and tapping two holes in the cross-slide and disengaging the feed nut.



Taper attachment made by the Master Taper Company

Transformer Relief Drive

A cover-mounted mechanical relief device that will quickly vent internal transformer pressures caused by electric arcs or overloads is announced by the Westinghouse Electric Corporation. Designed to fit any transformer with a 9-in. handhole opening, adapters can be used for larger openings if necessary. The device will withstand full vacuum when filling the transformer with oil under vacuum on tanks designed for this method of filling. A locking method is also available so that the tank can be pressure tested in the factory or in the field.



The mechanical relief device with adapter plate about to be mounted on a transformer

A roller latching arrangement locks the vent tightly closed until the pressure for which the device is set is reached, when it trips the vent fully open. It can be set for 10 lb. per sq. in. and tripping takes place within ½ lb. pressure of this setting. A dome over the opening prevents rain from entering the transformer even after operation.

Resetting after operation is simple and requires no replacement parts other than new gaskets that can be made in the field if necessary.

Tests have indicated that the new relief device offers less resistance to escaping gasses than diaphragm types of relief devices and, in consequence, pressure within the transformer do not build up to excessive values, nor is oil vapor thrown as far when operating.

The mechanical relief device is 17 in. in diameter and stands approximately 7 in. above the transformer cover. It can be used on new transformers and is small enough in most cases so it can be applied to existing transformers without modifications.

Carbon Arc Torch

A Carbon arc torch, called the Flexarc, for brazing, soldering and supplying heat for light forging, preheating before welding and tempering operations is available from the Westinghouse Electric Corporation.

Each torch comes complete with two 10-ft. extra flexible welding cable leads attached; one pair ¼-in. x 6-in. carbon electrodes, and one pair 3/16-in. by 6-in. carbon electrodes. Leads are equipped with bayonet attachment plugs to fit the WT Midget Marvel and limited input welders.

The Westinghouse Flexarc carbon arc torch

NEWS

Grand Trunk To Build New Shop at Detroit

THE Grand Trunk Western has awarded a construction contract to the Walbridge, Aldinger Company of Detroit, Mich., for the erection, at East Yard in Detroit, of a masonry-block car repair shop and a steel-frame lumber shed, at an approximate cost of $65,000. The repair shop will be 230 ft. by 26 ft. and the shed—to be constructed with a corrugated asbestos transite roof and side walls—will measure 100 ft. by 20 ft. An additional $25,000 will be spent for machinery and tools. These facilities will replace those destroyed by fire in December, 1946.

Diesel Makers' Group Elects Officers

GORDON LEFEBVRE, president of the Cooper-Bessemer Corporation, was elected president of the Diesel Engine Manufacturers Association at the annual meeting in Chicago on December 10. Otto H. Fischer, president of the Union Diesel Engine Company, and L. W. Metzger, vice-president of the Baldwin Locomotive Works, were elected vice-presidents of the association. Robert H. Morse, Jr., vice-president and general sales manager of Fairbanks, Morse & Co., was reelected treasurer and Harvey T. Hill was reappointed executive director.

Elected to serve two years on the board of directors were George W. Codrington, vice-president of the General Motors Corporation and general manager of the Cleveland (Ohio) Diesel engine division; E. J. Schwanhausser, vice-president of the Worthington Pump & Machinery Corp.; A. W. McKinney, vice-president of the National Supply Company; and Messrs. Morse and Metzger. The following were elected to serve one year on the board: C. S. Herbert, executive vice-president, Enterprise Engine & Foundry Co.; W. E. Corrigan, vice-president, American Locomotive Company; Robert E. Friend, president of the Nordberg Manufacturing Company; and Messrs. Lefebvre and Fischer.

A.S.M.E. Railroad Division Installs New Officers

DURING two days of sessions sponsored by the Railroad Division at the annual meeting of the American Society of Mechanical Engineers, held December 1 to 5 at Atlantic City, N. J., the following new officers were installed to direct the activities of the division during 1948: Chairman P. W. Kiefer, chief engineer motive power and rolling stock of the New York Central System; and vice-chairman, B. S. Cain, assistant engineer, Locomotive Division of the General Electric Company. Other executive committee members are J. M. Nicholson, mechanical assistant to vice-preident of the Atchison, Topeka & Santa Fe; E. D. Campbell, consultant, American Car & Foundry Co.; K. A. Browne, research consultant, Chesapeake & Ohio; secretary, E. L. Woodward, western editor, *Railway Mechanical Engineer*. Mr. Browne is the incoming new member of the Executive Committee whose term expires in 1952.

Three new members of the General Committee with terms expiring in 1952 include B. M. Brown, general superintendent motive power, Southern Pacific; F. L. Murphy, chief engineer, Pullman-Standard Car Manufacturing Company, and B. W. Taylor, assistant to vice-president, engineering, General Steel Castings Corporation.

At an all-committee meeting preceding the technical sessions, it was voted that the Railroad Division will participate wtih an all-day meeting on some appropriate subject, probably testing of passenger cars, during the semi-annual meeting of the society, May 30 to June 4, 1948, at Milwaukee, Wis. Tentative plans were also set up for a two-day session of the Railroad Division during the next annual meeting of the society, November 28 to December 3, 1948, at New York.

During the locomotive Forum, which occupied morning and afternoon sessions on December 3, a paper was presented by Dr. M. M. Loubser, chief mechanical engineer, South African Railways, Pretoria, South Africa, entitled "The South African Railways from a Mechanical Engineer's Aspect."

A number of members of the Railroad Division were honored in the course of the society's meeting at Atlantic City. During the annual dinner Mr. Kiefer received the A. S. M. E. Medal for 1947, presented for distinguished service in engineering and science. At a Railroad Division luncheon in honor of Messrs. Loubser and Kiefer on December 3, the following were made fellows of the society: J. R. Jackson, mechanical engineer, A. A. R.

In celebration of its centennial year Switzerland's railroads built a replica (above left) of the first train run over their lines. The train, including the "Limmat" locomotive, toured leading Swiss cities throughout the summer. The first run of the original "Limmat" was from Zurich to Baden in August, 1847. The illustration at the right shows the "Limmat" next to one of the electric locomotives in general use today

"HERE'S WHERE I COME FROM"

"I'm the Tough Guy, the Chilled Car Wheel. Instead of just one birthplace, I've got all these. Look at 'em!"

- American Car & Foundry Co.
- Canadian Car & Foundry Co.
- Griffin Wheel Company
- Marshall Car Wheel & Foundry Co.
- Maryland Car Wheel Co.
- New York Car Wheel Co.
- Pullman-Standard Car Mfg. Co.
- Southern Wheel (American Brake Shoe Company)

Each spot on this map identifies the plant of a member of the Association of Manufacturers of Chilled Car Wheels — *a member who maintains the rigid quality controls* as set by the Association.

Each spot means a source of chilled car wheels — and a place where wheel scrap may be marketed. It marks the location of a reliable, responsible company — a company that is sure to be equally dependable in its output and in its business dealings.

AMCCW

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

Organized To Achieve Uniform Specifications — Uniform

For additional information, use postcard, pages 41-42

Mechanical Division; D. S. Ellis, vice-president, Lima-Hamilton Corporation; B. S. Cain, assistant engineer, Locomotive Division, General Electric Company; L. B. Jones, engineer of tests, Pennsylvania; L. E. Endsley, consulting engineer, Pittsburgh, Pa.; R. G. Henley, general superintendent motive power, Norfolk & Western, and C. B. Peck, managing editor, *Railway Mechanical Engineer*. Certificates were presented by E. W. O'Brien, president of the society.

Kiefer Honored by A.S.M.E.

PAUL W. KIEFER, chief engineer motive power and rolling stock of the New York Central System, has been awarded the A. S. M. E. Medal for 1947. The presentation was made at the dinner of the American Society of Mechanical Engineers on December 3 during the annual meeting held at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

The A. S. M. E. Medal, established by the society in 1920, is presented for distinguished service in engineering and science. The award cites Mr. Kiefer as "an eminent engineer and executive and pioneer in the development of road-capacity testing of steam locomotives" and is made for "outstanding achievement in railway transportation."

P. W. Kiefer (right), chief engineer of motive power and rolling stock, New York Central System, receiving the A.S.M.E. Medal from Eugene W. O'Brien, retiring president of the Society.

Mechanical Division Letter Ballot Returns

IN a circular dated December 5, the A. A. R., Mechanical Division, reports letter ballot results on a total of 48 propositions designed to improve equipment conditions which were recommended by various committees at the annual meeting of the Division in Atlantic City, N. J., last June. Four of these propositions related to brakes and brake equipment, nine to freight-car construction details, four to couplers and draft gears, two to geared hand brakes, one to locomotive counterbalancing, one to relined journal bearings, six to locomotive construction details, two to lubrication, ten to specifications for materials, and nine to wheels.

Propositions 1 to 42 to amend the standard and recommended practice of the Division were approved by letter ballot effective March 1, 1948, with the exception of Proposition 12 covering definitions and designating letters for cars which was approved effective immediately, and Proposition 27 governing tender axle design calculations and load ratings which was ordered held in abeyance pending further consideration by the Axle Research and Locomotive Construction Committees. Propositions 43 to 48, inclusive, covering revisions in the Wheel and Axle Manual, were approved effective January 1, 1948.

MAINTENANCE OF COUPLERS ON DRAFT GEARS

Coupler and draft gear maintenance is the subject of a circular, dated December 5. According to this circular, freight-car interchange inspection rules 18 and 20 are specific in their requirements for inspecting, gauging and maintaining couplers and coupler parts. The Manual of Standard and Recommended Practice, Page L-142, outlines the recommended practice for inspecting and maintaining draft gears and attachments. The circular states that, from reports received of train break-in-twos, it is apparent that the importance of properly maintaining these parts in accordance with the requirements is not fully appreciated by the roads as a whole.

At the suggestion of the Arbitration Committee, attention is again called to the importance of this matter and it is requested that strict instructions be reissued to all concerned to make every possible effort to insure full compliance with these rules and requirements, especially when cars are on repair tracks.

WHEEL AND AXLE MANUAL CORRECTION

In a circular letter dated December 5, the secretary of the Mechanical Division calls attention to dimensional error on page B-42F-1947 of the Wheel and Axle Manual which illustrates a gauge for 3/64-in. worn-through-chill and out-of-round for 33-in. wheels. The drawing shows the center gauge contact point to project 3/16 in. and this should be 3/64 in.

The Committee on Wheels has authorized a change in minimum hardness of contact points, as shown on B-42F-1947, from C-65 to C-60 Rockwell. Due to the transfer of coupler reclamation practices from Sec. L to Sec. C of the Manual, the note at the bottom of page B-74-1937 should be corrected to read as follows: "Note—Gauge dimensions shown represent the maximum allowance for new couplers. After reclamation per standard practice (see Manual pages C-65 to C-72, inclusive), the gauge must assemble on the shank as shown and swing 90 deg. on each side of the center line."

BRAKE HANGER BRACKETS ON UNIT TRUCKS

A letter, dated December 5, refers to the interchange of cars equipped with hangerless-type brake beams used with Unit trucks which were authorized in 1939, with provision that the side frames must have A. A. R. standard brake hanger brackets cast integral therewith in order that A. A. R. standard No. 15 or A. A. R. No. 3 brake beams could be substituted in repairs.

The circular states that, due to the comparatively small number of brake-beam failures reported, the fact that 62 railroads now have a considerable number of cars in service equipped with the hangerless-type brake beam, and the fact that a number of other railroads have arranged to stock such beams for repair purposes, the General Committee has ruled that, effective immediately, brake-hanger brackets are no longer required on truck side frames for new cars on which Unit brake beams are specified.

An arrangement has been made whereby brake beam manufacturers have agreed to furnish Unit-type brake beams to member railroads who do not use this type of beam on their own cars, on consignment basis for repairs to foreign cars (if desired) and to be paid for only when used.

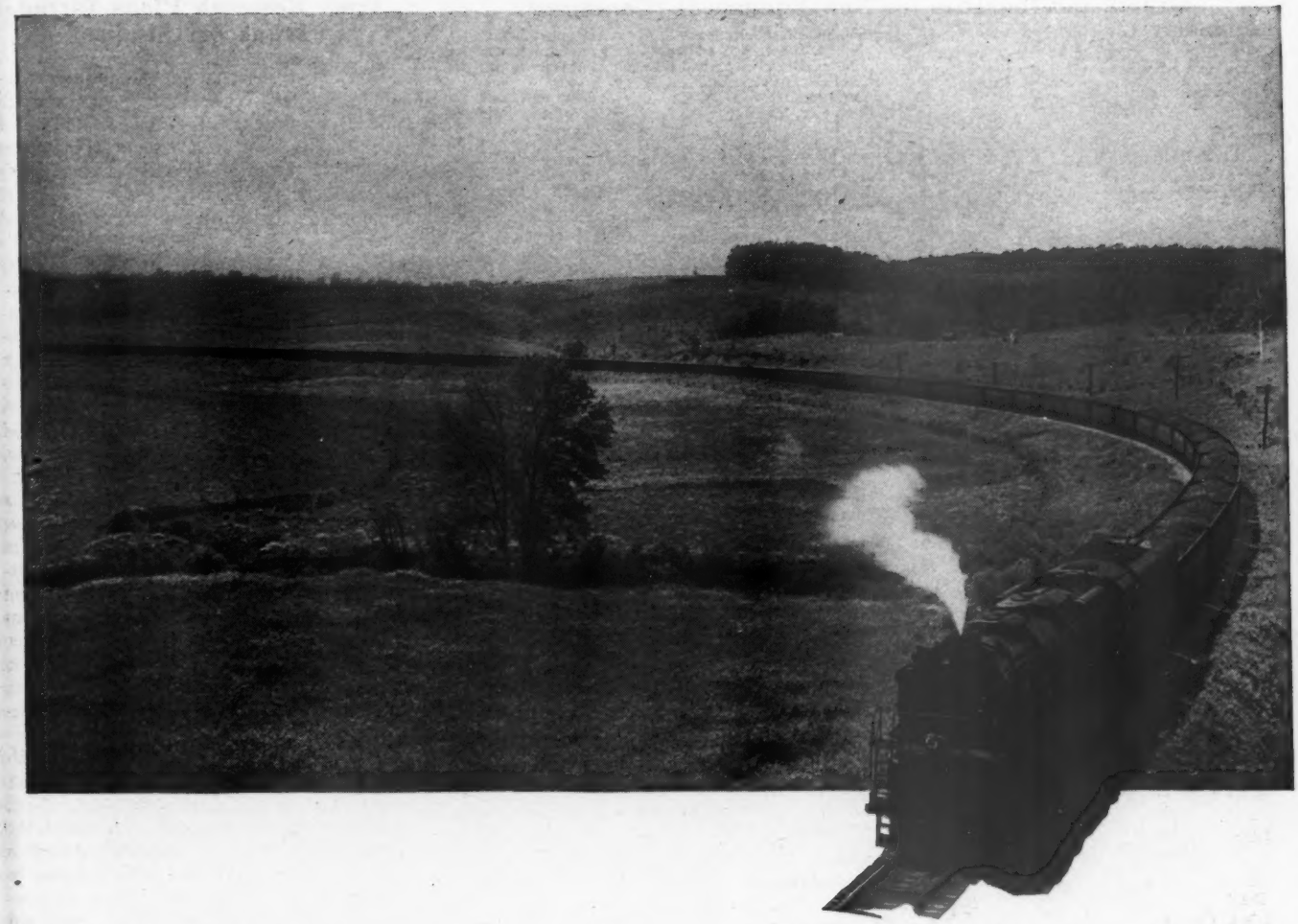
McGlaughlin, Bituminous Coal Research Appointee

CHARLES E. MCGLAUGHLIN has joined the headquarters staff of Bituminous Coal Research, Inc., as special representative to maintain contact with B. C. R. members, coal producers, railroads, and manufacturers of coal-burning equipment. He succeeds T. A. Day, who has joined the public relations staff of the Bituminous Coal Institute, an affiliated organization.

Orders and Inquiries for New Equipment Placed Since the Closing of the December Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Baltimore & Ohio	20[1]	1,500-hp. Diesel-elec. frt.	Electro-Motive
Canadian National	2[2]	3 unit, 4,500-hp. Diesel-elec. road	Electro-Motive
Chesapeake & Ohio	30[3]	0-8-0 steam switch.	Baldwin
	15[3]	2-6-6-6	Lima-Hamilton
Chicago & North Western	15[4]	1,500-hp. Diesel-elec. frt.	Electro-Motive
	6[4]	2,000-hp. Diesel-elec. pass.	Electro-Motive
	1[4]	1,500-hp. Diesel-elec. switch.	American Loco.
Chicago, Burlington & Quincy	4[5]	2,000-hp. Diesel-elec. pass.	Electro-Motive
	1[5]	4,000-hp. Diesel-elec. pass.	Electro-Motive
	15[5]	6,000-hp. Diesel-elec. frt.	Electro-Motive
	1[5]	4,500-hp. Diesel-elec. frt.	Electro-Motive
Chicago Great Northern	8	1,500-hp. Diesel-elec. switch.	American Loco.
	5	1,000-hp. Diesel-elec. switch.	Electro-Motive
	9	2,000-hp. Diesel-elec. road switch.	Electro-Motive
	4	3,000-hp. Diesel-elec. pass.	Electro-Motive
Detroit, Toledo & Ironton	7[6]	1,000-hp. Diesel-elec. switch.	Electro-Motive
Kansas City Southern	10[7]	1,000-hp. Diesel-elec. switch.	Electro-Motive
Louisiana & Arkansas	1[7]	2,000-hp. Diesel-elec. frt.	Fairbanks-Morse
Minneapolis, St. Paul & Sault Ste. Marie	5[8]	3,000-hp. Diesel-elec. frt.	American Loco.



HIGH SPEED FREIGHT DEMANDS EMPHASIZE THE NEED FOR . . .

MODERN POWER

Today's freight demands can only be met through a maximum of operating efficiency . . . operating efficiency that is backed up by MODERN Motive Power, capable of hauling increased loads at higher speeds. Reduced running time means increased availability . . . and increased availability means increased revenues. « Lima-built Modern Steam Locomotives have shown what Modern Steam Power can do to decrease running time and increase availability and freight revenues.

LIMA HAMILTON CORPORATION

LIMA, OHIO
Lima Locomotive Works Division
Lima Shovel and Crane Division

LIMA-HAMILTON CORPORATION

HAMILTON, OHIO
Hooven, Owens, Rentschler Co.
Niles Tool Works Co.

For additional information, use postcard, pages 41-42

Orders and Inquiries for New Equipment *(Continued)*

Long Island	18[9]	600-hp. Diesel-elec. switch.	American Loco.
	15[9]	1,000-hp. Diesel-elec. switch.	American Loco.
New York Central	7	1,500-hp. Diesel-elec. road switch.	American Loco.
	8	Diesel-elec. pass.	American Loco.; Electro-Motive; Fairbanks-Morse
	17	Diesel-elec. frt.	
	15	Diesel-elec. transfer	
	64	Diesel-elec. switch.	
	7	Diesel-elec. road switch.	
Northern Pacific	3	1,500-hp. Diesel-elec. road switch.	Baldwin Loco.
	2	6,000-hp. Diesel-elec. frt.	Electro-Motive
Pennsylvania	4	600-hp. Diesel-elec. switch.	American Loco.
	6	1,000-hp. Diesel-elec. switch.	American Loco.
	12	600-hp. Diesel-elec. switch.	Baldwin Loco.
	15	1,000-hp. Diesel-elec. switch.	Baldwin Loco.
	18	600-hp. Diesel-elec. switch.	Electro-Motive
	22	1,000-hp. Diesel-elec. switch.	Electro-Motive
	23	1,000-hp. Diesel-elec. switch.	Fairbanks-Morse
	25	380-hp. Diesel-elec. switch.	General Electric
Peoria & Pekin Union	2	1,000-hp. Diesel-elec. switch.	Electro-Motive

Locomotive Inquiries

Road	No. of locos.	Type of loco.	Builder
Wabash	7	1,000-hp. Diesel-elec. switch.	
	3	600-hp. Diesel-elec. switch.	

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Baltimore & Ohio	1,000[10]	70-ton hopper	Bethlehem Steel
	1,000[10]	70-ton hopper	Pressed Steel
Chesapeake & Ohio	200[11]	50-ton automobile	Pressed Steel Car
Chicago, Burlington & Quincy	1,100	50-ton box	Co. shops
	500	70-ton hopper	Co. shops
	250	70-ton ballast	Co. shops
	300	50-ton flat	Co. shops
	200	70-ton tank	Co. shops
Detroit, Toledo & Ironton	10	50-ton ballast	Magor Car
	100	50-ton box	American Car & Fdry.
	100	70-ton covered hopper	American Car & Fdry.
	50	70-ton hopper	Greenville Steel Car
Denver & Rio Grande Western	500	50-ton gondola	Pressed Steel Car
	50	70-ton gondola	Pressed Steel Car
	100	40-ton stock	Co. shops
Great Northern	200	50-ton gondola	American Car & Fdry.
	75	70-ton covered hopper	American Car & Fdry.
Missouri-Illinois	100	70-ton hopper	Mo. Pac. shops
Missouri Pacific	1,000	50-ton gondola	Co. shops
New York, Chicago & St. Louis	400	50-ton box	Pullman-Standard
	400	70-ton gondola	American Car & Fdry.
Northern Pacific	500	Box	Co. shops
	200	Flat	Co. shops
	250	70-ton ballast	American Car & Fdry.
Wabash	20	Caboose	Co. shops
	118	Gondola	Co. shops

Freight-Car Inquiries

Road	No. of cars	Type of car	Builder
Carbon County	300	70-ton hopper	
Elgin, Joliet & Eastern	300	50-ton coke	
Nashville, Chattanooga & St. Louis	50	70-ton gondola	
Pacific Fruit Express	3,000	40-ton refrigerator	
Reading	1,000	50-ton twin hopper	
Southern Pacific System	3,350[12]	50-ton box	
	2,650[12]	Flat	
	3,400[12]	Gondola	
	350[12]	70-ton covered hopper	
	80[12]	Caboose	

[1] For delivery during second quarter of 1948.

[2] In announcing the order, R. C. Vaughan, chairman and president of the Canadian National, cautioned against underrating the worth of steam locomotives. The modern steam engine, he said, is the product of more than a century of motive power technology and many factors must be weighed in evaluating the merits of the two forms of motive power.

[3] Delivery of the 0-8-0 locomotives, which will cost $3,400,000, will start in June, 1948. The 2-6-6-6 type will cost $5,800,000 and their delivery is scheduled for next July.

[4] The 1,500-hp. freight locomotives to be delivered in March, 1949; the 2,000-hp. locomotives in January, 1949, and the 1,500-hp. switcher in January, 1948.

[5] With the exception of 9 2,000-hp. Diesel-electric road-switching locomotives, this purchase includes all the motive power recently authorized by the road's board of directors. This additional motive power, it was stated, will permit not only the Dieselization of additional train mileage on the Burlington, but that of the "time" freight trains of the Colorado & Southern and the Fort Worth & Denver City (parts of the Burlington system). The equipment will also allow the extension of Diesel freight and passenger service to several lines of the road which have no Diesel service.

[6] For delivery in September, 1948.

[7] Delivery scheduled for the second quarter of 1948.

[8] Delivery expected during the first half of 1948. The Minneapolis, St. Paul & Sault Ste. Marie recently received one of five 3,000-hp. Diesel electric freight locomotives on order with the Electro-Motive Division of General Motors Corporation.

[9] The 18 for delivery in May, 1948; the 15 for delivery in February, 1949.

[10] The mention of the Budd Company in connection with the inquiry for this equipment in the December issue was erroneous.

[11] For delivery in May, 1948. To cost $1,340,000.

[12] In announcing these inquiries, President A. T. Mercier said actual placing of the orders would be expedited with a view to securing earliest possible delivery. The new box cars will be of wood-lined steel construction for general service and the covered hopper cars will be particularly suited to the transportation of granular products. Among the gondola cars will be some 60-ft. units with drop-ends, especially useful in the handling of long timber and steel shipments, while others are to be 50-ton 41-ft. units for hauling sugar beets. The flat cars will include 50-ton capacity 40-ft. and 70-ton capacity 53-ft. lengths and the cabooses are to be provided with "bay windows" instead of cupolas.

Notes:

The War Assets Administration has negotiated the sale of an additional 751 surplus troop sleepers which remained in inventory after previous fixed price and sealed bid sales. The original inventory of 1,300 had been reduced by sale at fixed prices of $3,780 each for cars built in 1945 and 1946 and $2,880 each for cars built in 1943 and 1944. In the final negotiations, 50 cars were sold to the Chesapeake & Ohio and 701 to the U. S. Department of Interior for transfer to the Alaskan Railroad.

The *Chicago, Burlington & Quincy*, according to C. H. Buford, president, will purchase the following Diesel-electric locomotives at a total cost of $6,288,000: eight 3,000-hp. freight, six 2,000-hp. passenger, 20 1,000-hp. switching and four 1,500-hp. designed for either switching or road service. All through passenger trains of the Milwaukee between Chicago-Milwaukee, Wis., and St. Paul, Minn.-Minneapolis will be drawn by Diesel power when the new equipment is placed into service, Mr. Buford stated. In addition, Diesels will be used on all of the road's passenger trains between Chicago and Madison, Wis., Mason City, Iowa, and Sioux Falls, S. D. Mr. Buford also pointed out that the 20 new switchers will contribute materially to the road's program to Dieselize its terminals. The new equipment will bring the total number of Diesel-electric locomotives on the Milwaukee to 175.

The *Pittsburg & Shawmut* has purchased five booster-equipped Mikado-type steam locomotives from the Chicago, Indianapolis & Louisville.

Army Research Plans Include Transport Studies

Several transportation studies are included in the War Department Research and Development Program for the fiscal year ending June 30, 1949, according to an outline of the program which was recently made public. The rail-transport phase will involve studies of motive power, cars and special equipment.

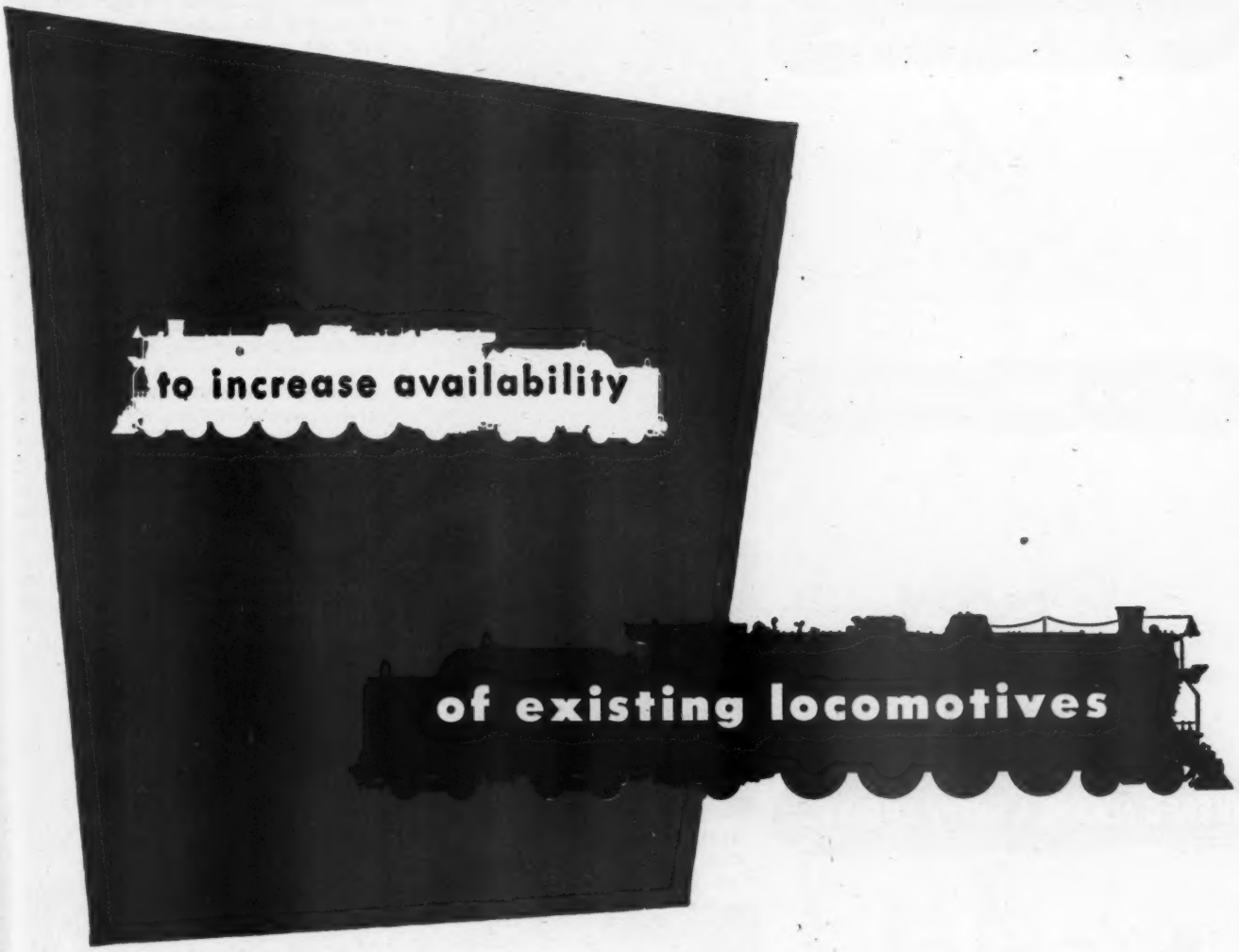
One study already under way has been concerned with "a lightweight Diesel engine specifically designed for long life between overhauls with a minimum of maintenance." Further study of this "basic power plant," as the War Department statement put it, will bring under investigation "a series of engines with suitable range of horsepowers adaptable to locomotive, crane, marine and general application."

Motive power under study includes a "50-ton, 0-4-4-0 Diesel-electric locomotive suitable for both road and switching service on 56½-in. gage railroads in foreign theaters." This is expected to supersede present designs of locomotives ranging from 45 tons to 80 tons. Also under study is a 100-ton, 56½-in. gage, 2-8-2 steam locomotive "to be designed to foreign railroad limitations, to supplement, if required, the Diesel-electric for theater-of-operations service."

After development of the 50-ton Diesel-electric, projects of modified designs for locomotives of this type with 60-in., 63-in., and 66-in. gage trucks will be initiated, the statement also revealed. It explained further that a similar locomotive will likewise be developed for foreign service on narrow-gage track—39⅜ in. and 42 in. Still another development will be a heavy Diesel-electric locomotive of approximately 127 tons, which is expected to embody the lightweight engine mentioned above. This will be for standard and wider gage tracks, and it would furnish power "for heavy mainline service on military railroads in foreign theaters."

Cars under development for service in foreign theaters on 56½-in. and wider gage include a series of 40-ton, eight-wheel, flat, gondola and box cars, a hospital unit car, and an 80-ton car for the transport of heavy combat tanks and other special units as well as general freight. The future program contemplates the development of improved designs of four-wheel, 20-ton cars of standard and wider gages for foreign service; of eight-wheel, 30-ton cars of narrow gages of various types suitable for military service; of troop sleeping and kitchen cars of standard gage for domestic service; and of "special cars meeting specific requirements for foreign service."

As for special rail equipment, the War Department statement said that development work is continuing on locomotive and wrecking cranes of 56½-in. gage, suitable for foreign service; while roadway machines (inspection, maintenance and push cars) adapted for military service on foreign railroads "are in the preliminary development stage." Other studies in the rail transport program include those on (1) motive power components, including transmissions of various types; (2) car components, including trucks and brakes; (3) the application and tests of radio communication between locomotive and train crews



Road experience shows Security Circulators definitely tend to reduce honeycombing, flue plugging and cinder cutting, and to prolong the life of arch brick. Consequently the installation of Security Circulators in existing steam locomotives makes them available for *continuous operation* for longer periods between shoppings.

The resulting gain in locomotive availability will rapidly repay, through the increased earning power of the locomotive, the cost of installing Security Circulators.

AMERICAN ARCH COMPANY, INC.

NEW YORK • CHICAGO

SECURITY CIRCULATOR DIVISION

WHEN A MAN WITH A PROBLEM---
MEETS A BEATTY ENGINEER---
THERE'S ALWAYS A HAPPY ENDING—
FOR TWO HEADS ARE BETTER THAN ONE
—ESPECIALLY IF THE OTHER ONE IS OURS!
THERE'S A BETTER WAY TO DO IT!
HYDRAULIC
SHEET METAL WORKING
EQUIPMENT
BEATTY
MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.

BEATTY Spacing Table handles flange and web punching without roll adjustment.

BEATTY No. 11-B Heavy Duty Punch widely used in railroad industry.

BEATTY Hydraulic Press Brake for V-bending, forming, pressing, flanging.

BEATTY CoPunShear, one unit does coping, punching, shearing.

and ground crew stations for improved dispatching and the control of yard movements; (4) studies and tests of Arctic operation of rail equipments; (5) "tropicalization" of components; and (6) the "air transportability" of rail equipment.

Lawrence Wilcox Sec.-Treas. Air Brake Association

LAWRENCE WILCOX has assumed the duties of secretary and treasurer of the Air Brake Association, with headquarters at Room 827, 80 East Jackson Boulevard, Chicago 4. Mr. Wilcox, who, until his retirement on December 1, was steam road representative, western district, of the Westinghouse Air Brake Company at Chicago, was born at Winona Lake, Ind., on October 15, 1882. He began his career in 1901 as a fireman in the employ of the Lake Shore & Michigan Southern and in 1905 became a locomotive engneer. He entered the service of the Westinghouse Air Brake Company in March, 1911, as mechanical expert in Chicago. In 1933 he was placed in charge of the company's

Lawrence Wilcox

office at Columbus, Ohio. When that office was closed in 1933 he was transferred to the Chicago office as steam road representative of the western district.

A.A.R. Research Projects

MORE research projects are now being carried on by the Association of American Railroads than at any other time, President William T. Faricy reported to that organization's board of directors at its recent meeting in Chicago. These projects, Mr. Faricy said, deal with practically every phase of railroads and railroading, and have as their objective the improvement of railroad operations, service, efficiency, economy and safety.

During the past year, Mr. Faricy stated, A. A. R. research activities have ranged from such things as the determination of the cost of stopping a train to the counterbalancing of locomtives for high-speed service. These activities, he added, were conducted not only by A. A. R. personnel, but also by some 200 technical committees working with the engineering and mechanical research forces of the organization.

Among the numerous studies made by the A. A. R., Mr. Faricy continued, were

Rail Damage by Slipping Locomotives

"The damaging effect on rails of slipping locomotive driving wheels, and possible palliative treatments, have been the subject recently of study and experiment by the University of Illinois, including the anchorage of a 2-8-2 locomotive on a test track and the deliberate slipping of its driving wheels for 5 sec. periods over selected rails. The effect is to heat the rail steel to above the quenching temperature, after which the rapid cooling of the affected metal by conduction produces the extreme hardness of a martensitic steel structure on the railhead, readily visible as what is called an "engine burn." Moreover, the martensitic transformation creates minute cracks in the steel, which reduce its resistance to fatigue and eventually may develop to such an extent as to cause failure. Experiments were made in the welding up of rail-heads affected in this way. An essential was that all the martensitic or burned metal should first be removed by grinding, and also any metal showing cracks immediately outside the burned area, where some of the greatest stresses are developed at the time of the slipping. Although the data available as yet are small, the results indicate that engine-burned rails which have been welded up show an appreciable advantage in subsequent service over those which have been left in their damaged condition. The main necessity would seem to be some reconsideration of locomotive adhesion factors to reduce the slipping itself to a minimum."

THE RAILWAY GAZETTE

September 26, 1947

A Problem

AMERICAN THROTTLE COMPANY
INCORPORATED
60 East 42nd Street, New York 17, N. Y.
122 S. Michigan Avenue, Chicago 3, Ill.

The Solution

With THROTTLE MASTER *slipping can be controlled*

NEW CLEANING IDEAS

For Further Details Write Magnus

Utility Cleaning Machine for Small Parts—The Magnus Aja-Dip Jr—is ideal for use with Magnus 755 in removing grease and carbonized oil from small parts. Can be used with alkaline and other types of cleaners as well.
No. 132

Dangerous Hand Cleaners are Costing You Plenty! If your personnel is using harsh, gritty hand cleaners, it will pay you to study Magnus Bulletin 51—"The Care and Cleaning of Hands and Arms." Write for a copy and see what a safe hand cleaner can do to cut time losses.
No. 133

Having Any Trouble with Fuel Oil Sludge? Clogged screens? Carbonized burner tips? Poor combustion control? Magnus Clerex stops sludge formation in the heaviest oils. All you need is a few drops per gallon!
No. 134

Clean up your Shop Machines with Magnusol. You don't have to dismantle. Just spray on the usual 1-8 Magnusol-kerosene mixture, let soak and pressure rinse with water. You get completely clean machines, without harm to any parts or painted surfaces.
No. 135

Try Magnus 755 on Those Stubborn Bull Rings

Whenever you have to clean a badly carbonized bull ring, remember that Magnus 755 was specifically designed for the removal of stubborn carbon deposits. This neutral emulsion-solvent cleaner was originally developed for the Army Air Forces to solve the wartime problem of removing the really tough carbonized oil deposits met with in the parts of combat plane engines. Since the war it has been universally successful on all types of carbonized deposits.

On bull rings, the working solution is made up of eight parts Magnus 755, covered with a water seal of two parts to prevent loss of volatile ingredients. Cleaning temperature is 150°F. Rings are soaked for 12-18 hours in this solution, then pressure rinsed with water. Light brushing may be required in a few rare cases to remove residual deposits, but ordinarily hand work is not necessary.

In a Magnus Aja-Dip Cleaning Machine, where dynamic agitation is provided, bull rings can be cleaned in Magnus 755 in a few hours.

Cuts Diesel Parts Cleaning Time by 75%

Magnus 755, in this Magnus Aja-Dip Cleaning Machine, does a better cleaning job in two hours on liners than an ordinary solvent in a still tank used to do in 18! Heads which formerly took 24-30 hours are cleaned by this Magnus combination in four! On the average, parts are now cleaned and

ready for reinstallation in about one-fourth the time formerly required. Not only are they cleaned faster and better, but hand work has been practically eliminated.

There is no more effective cleaner for carbonized oil deposits than Magnus 755. And the range of capacity in Magnus Aja-Dip Machines makes it possible to meet any required volume of parts called for in your shop.

Magnusol Simplifies Air Filter Cleaning

Just dip any type of air filter in a 1 to 6 Magnusol-kerosene mixture. Then drain, rinse with water under pressure or with a steam gun. After drying, filters are ready for re-oiling without any further treatment. Safe, sure and speedy, the Magnusol method insures efficient filtering action at all times.

Magnus Chemical Co., 77 South Ave., Garwood, N. J. In Canada—Magnus Chemicals, Ltd., 4040 Rue Masson, Montreal 36, Que. Service representatives in principal cities.

those pertaining to radio communication, radar and electronics, centralized traffic control, hot box alarm devices, lightweight freight cars, refrigerator cars and motive power. During 1947, he reported, the Railroad Committee for the Study of Transportation completed its five-year survey of the postwar economic and transportation situation. The committee, he said, issued a total of 160 reports.

Mr. Faricy declared that during 1948 the A. A. R. will carry on research "with greater vigor, in more directions, on a broader front and with more promising possibilities than ever before." The Engineering Division and the Signal Section will carry on numerous projects; the Communications Section will progress more than 100 projects dealing with improved practices and developments in its field, and the Mechanical Division has more than 60 subjects assigned to it concerning improvements in locomotives and cars.

Supply Trade Notes

LOCOMOTIVE FINISHED MATERIAL COMPANY.—The Locomotive Finished Material Company, Atchison, Kan., during December completed celebration of the seventy-fifth anniversary of its founding. An attractive 3½-in. round bronze medallion was struck off in honor of the event. The company originated in 1872 as the John Seaton Foundry to supply locomotive cylinder and other castings to railways in the Southwest, primarily the Atchison, Topeka & Santa Fe. In 1905, a machine shop was added and the Locomotive Finished Material Company was formed to manufacture finished materials such as pistons and valves, cylinder and valve bushings, rings, driving wheel centers, crossheads, etc., for distribution and use throughout the country. Title to the foundry was acquired in 1924 and since that time the entire plant has been operated under the present name. The company does extensive business in both the railway and oil industries and during the recent world war made machine tools, cast armor for M-4 tanks and maneuvering valves for naval ships. For Diesel locomotives the company manufactures and supplies a large number of both lightweight and standard cast-steel truck frames.

The medallion shows on one side an embossed view of the small original foundry in 1872 and below it the greatly enlarged plant of 1947. On the other side is an oil-field scene at the top, superimposed Diesel and steam-locomotive trains at the center and an inspection around the periphery and at the bottom.

◆

WITCO CHEMICAL COMPANY.—*Dr. John H. Lux* has been appointed director of research on asphaltic specialties at the Chicago Research Laboratory of the Witco

Old Man Winter doesn't stand a ghost of a chance where General Motors Diesels operate. For these reliable locomotives perform with the same high efficiency in December as they do in May.

On the Great Northern mainline between St. Paul and Seattle, temperature runs the gamut from 100 degrees in summer to 50 below in winter, the quickest and sharpest range of climatic conditions in all America. Terrain varies from the North Dakota plains to an elevation of 5,213 feet at the Continental Divide.

The record for dependability of General Motors Diesels in this rugged service is one in which the locomotive builder and the railroad can both take justifiable pride. Five GM Diesel high-speed passenger locomotives which pull the Empire Builder, show an average availability of 98.6% while amassing a total of 2,463,040 miles.

So uniform is their efficiency, winter and summer, that there is only half a percentage point difference in the availability average for any of the locomotives in their fleet. Each of the five has averaged over 22,000 miles a month for more than two years.

Such actual records, in all kinds of service, distinguish General Motors Diesels. Such actual records point up the extra value inherent in these locomotives, designed and built by specialists in America's best-equipped plant devoted 100% to the manufacture of Diesel motive power.

GM LOCOMOTIVES

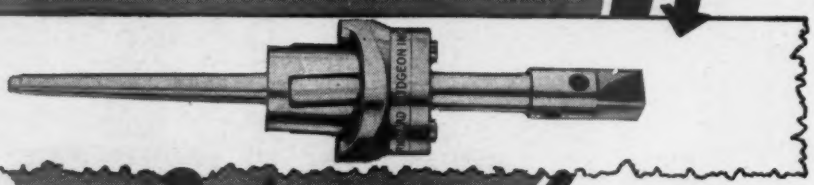
ELECTRO-MOTIVE DIVISION

GENERAL MOTORS — LA GRANGE, ILL.

DUDGEON
HIGH EFFICIENCY
TUBE EXPANDERS
Quality-built to lower costs!

It means a lot to the user to know that each DUDGEON expander can be unqualifiedly depended upon to give consistently good results . . . quickly, with less effort. It means a lot to the buyer too, toward lower unit costs and better workmanship. This confidence — implicit in DUDGEON products for almost a century — results from the same modern manufacturing techniques and rigid quality control that have consistently raised the quality and lowered the costs of these fine tools.

DUDGEON TYPE 22
Highest quality tool obtainable for all general tube rolling in railroad maintenance and boiler repair work. Simplified design provides unusual economy of operation. Hardened guide ring bears against hardened one piece frame for maximum resistance against grit and scale. Rollers are reversible



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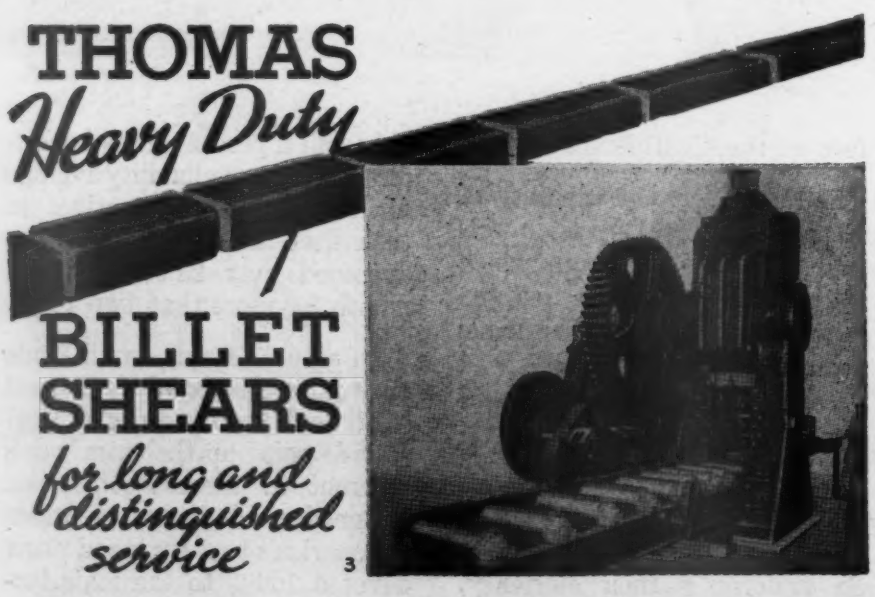
MFRS. OF TUBE EXPANDERS SINCE 1853
24 COLUMBIA STREET, NEW YORK 2, N. Y.

Complete literature on Dudgeon products — expanders, hydraulic pumps and jacks — available. Write today. Address inquiries to Department

THOMAS
Heavy Duty
BILLET
SHEARS
for long and distinguished service



THOMAS *Heavy Duty* Billet Shears are built in capacities from 500 to 2000 tons, with the primary objective of delivering to the user many years of efficient, trouble-free service. *And they do!*

Write for Bulletin 311

THOMAS
MACHINE MANUFACTURING COMPANY

Chemical Company, 6200 West Sixty-first street, Chicago 38.

Dr. John H. Lux was formerly assistant director of research of the Neville Company, Pittsburgh, Pa., and research engineer, Carbide Carbon Chemical Corporation, South Charleston, W. Va. He received his Ph.D. degree in chemical engineering from Purdue University in 1941, and was an instructor in the Department of Chemistry and Chemical Engineering at Purdue for three years. Dr. Lux is a member of the American Institute of Chemical Engineers, and the American Chemical Society. At the Witco Laboratory, he will be engaged in directing research and development in connection with Witco asphaltic specialties, including Witcote sound deadener, vibration dampener, and railway mastics.

◆

KENNAMETAL, INC. — *Jerome G. Brady* has been appointed tool engineer and representative of Kennametal, Inc., working out of the Pittsburgh, Pa., district office. *Lester Speickhoff* has been appointed tool engineer and representative in the Syracuse area.

◆

AIRCRAFT SCREW PRODUCTS COMPANY; HELI-COIL CORPORATION.—The name of the Aircraft Screw Products Company, Inc., of Long Island City, New York, has been changed to the Heli-Coil Corporation in order that the name may be more truly descriptive of the company's activities which have expanded beyond the aircraft industry. Heli-Coil screw thread inserts are the principal product of the company.

◆

AMERICAN LOCOMOTIVE COMPANY.—The American Locomotive Company has completed a tool designing and manufacturing department in a new building at the Schenectady, N. Y., works, which brings together in a central location the formerly scattered facilities for designing and manufacturing small tools, jigs and fixtures, templates and dies. The 65-ft. by 288-ft. two-story building houses a heat-treating department equipped with electric salt baths for tempering of high-speed tools, a high-speed hardening machine for uniform hardening of chisels, a special machine for tool cleaning, an air-conditioned, constant-temperature gauge checking room, and modern comparators and gauge checking equipment.

◆

AMERICAN HOIST & DERRICK CO.—*John L. Beard* has been appointed manager of the small parts division of the American Hoist & Derrick Co., at Minneapolis, Minn.

◆

BULLARD COMPANY. — *Louis J. Baudis* has been appointed chief engineer of the Bullard Company, machine tool plant at Bridgeport, Conn. *Robert W. Waring* has been appointed assistant chief engineer and *Joseph C. Olson* head of the Service and Demonstration department.

Mr. Baudis has been associated with the machine tool plant since 1935 and has served as development engineer and assistant to the vice-president in charge of manufacturing.

Mr. Waring was formerly chief engineer of a division of the Bridgeport Brass Company and material and process engineer of the Sperry Gyroscope Company.

Mr. Olson has been associated with Bullard Company since 1935 and has been head of the Tool Control division, night superintendent, and assistant to the works manager.

◆

NATIONAL BRAKE COMPANY.—The National Brake Company has apointed *W. O. Bussenius & Co.* as mid-western representative for the sale and service of Peacock

W. O. Bussenius

brake equipment. W. O. Bussenius & Co. will have headquarters at 310 South Michigan avenue, Chicago.

◆

INDUSTRIAL EQUIPMENT COMPANY.—The Industrial Equipment Company, Louisville, Ky., has been appointed a distributor of the entire line of industrial hose, belting and packing of the Hewitt rubber division of *Hewitt-Robins, Inc.*

◆

AMERICAN CAR & FOUNDRY CO.—*Jerry M. Gruitch,* formerly vice-president in charge of engineering and a member of the board of directors of the O. A. Sutton Corporation, has been appointed director of

Jerry M. Gruitch

research and development of the American Car & Foundry Co.

Jerry M. Gruitch began his business career with the Ford Motor Company in 1921 as an apprentice toolmaker. He advanced to personnel supervisor before leaving in 1929 to study engineering at the University of Michigan. In 1934 he joined the Chrysler Corporation as experimental engineer and by 1941 he had been appointed

Slowly revolving outlets distribute the heated air continuously downward in a constantly changing direction, completely and thoroughly covering the working area

Write for details

L. J. Wing Mfg. Co.

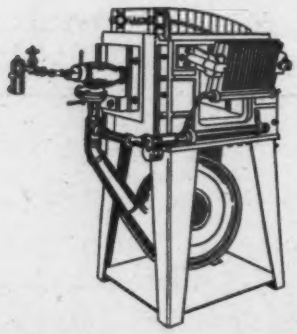
154 W. 14th Street

New York 11, N. Y.

Factories: Newark, N. J. and Montreal, Canada

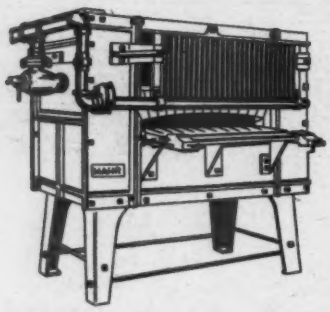
RAILROAD **MAHR** EQUIPMENT

BUILT BY SPECIALISTS in railroad equipment for 33 years, MAHR forges, torches, furnaces, burners, blowers, valves and similar equipment are dependable, safe, efficient and economical.



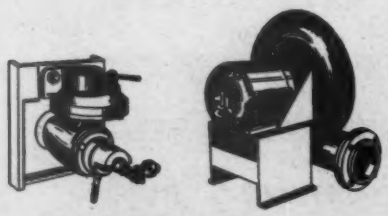
MAHR NO. 35 RIVET HEATER & FORGE

This combination Rivet Heater and Forge handles 800 ¾" x 3" rivets or 100 to 125 lbs. of small parts per hour. With opening 12" x 5" and heating chamber 17½" x 13½", this unit is very popular for forming or forging, and heating of small bars, upsetting and the like. May be equipped with gas or oil burner and low pressure combustion air blower. Other models also available for use on compressed air.



MAHR MODEL "CA" SLOT TYPE FORGE

Ruggedly constructed with a heavy cast iron frame, this forge is built for long, hard service. Ideal for heating bar stock of larger diameters. Slot opening up to 5" high, as wide as 48". Water cooled shield, air curtain and adjustable stock rest. Available with single opening as shown, with double front opening, or with opening both front and back. Gas or oil fired.



MAHR BURNERS AND BLOWERS

MAHR oil or gas burners supply a steady flow of intense heat. Start quickly, easily . . . adjust instantly . . . remain constant as set . . . burn in bright, sharp, clean flame. Available in low pressure and compressed air models. MAHR Centrifugal Blowers are designed for maximum efficiency, economy and performance. 9 standard sizes; 16 discharge positions. Individual MAHR Blowers cost less than central blower system . . . save up to 50% on power costs . . . deliver constant air pressure.

WRITE for Bulletins on

MAHR RIVET HEATERS • FORGES • TORCHES
FURNACES • BURNERS • BLOWERS • VALVES
TIRE HEATERS • FIRE LIGHTERS

MAHR MANUFACTURING CO.
DIVISION OF DIAMOND IRON WORKS, INC.
1700 2nd St. N. MINNEAPOLIS, MINN.

chief engineer of research and development of heating and refrigeration in the company's Airtemp division. From 1941 to 1945 he served in the army. After leaving the service Mr. Gruitch was appointed assistant chief engineer at the Dodge division of Chrysler, holding that position until he joined O. A. Sutton.

◆

SAFETY CAR HEATING & LIGHTING CO.—*Charles W. T. Stuart,* formerly vice-president in charge of sales of the Safety Car Heating & Lighting Co., has been elected executive vice-president. *E. K. Goldschmidt,* formerly assistant manager of the Chicago district office, has been appointed manager, to succeed *C. A. Pinyerd,* retired.

Charles W. T. Stuart

Charles W. T. Stuart began his business career with the Baldwin Locomotive Works in 1908. From 1909 to 1924 he worked in the motive power department of the Pennsylvania and, in the latter year, joined the Safety Car Heating & Lighting as a sales representative. He was appointed Southeastern district manager in 1933 and also Philadelphia, Pa., manager of the Vapor Car Heating Company. Mr. Stuart was appointed assistant to the president of Safety Car Heating & Lighting in 1943, and was elected vice-president in charge of sales in 1946.

E. K. Goldschmidt

◆

SYMINGTON-GOULD CORPORATION.—*Donald S. Barrows,* vice-president of the Symington-Gould Corporation and its predecessor companies, has been elected president, succeeding *Edward Hungerford,* who has been elected chairman of the board.

. . . designed for You!

To help you do your work better, faster and safer, Plomb is continually developing new tools. During the past year alone, 124 high-quality tools, sets and containers were added, and a great many older tools were improved. To get the *best* as well as the *latest* tools, buy from your Plomb Dealer. Write for catalog to

PLOMB TOOL COMPANY
2280 Q SANTA FE AVE.
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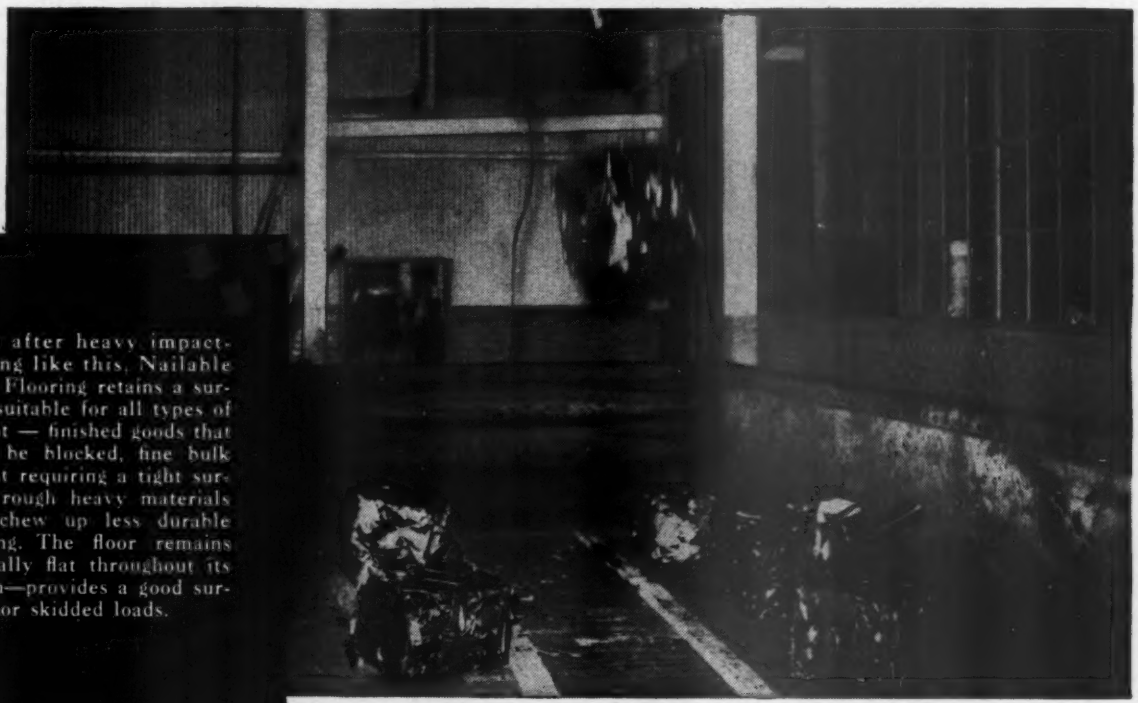
4772

PLOMB Streamlined TOOLS

New NAILABLE STEEL FLOORING

for a new low in car maintenance costs!



Even after heavy impact-loading like this, Nailable Steel Flooring retains a surface suitable for all types of freight — finished goods that must be blocked, fine bulk freight requiring a tight surface, rough heavy materials that chew up less durable flooring. The floor remains generally flat throughout its length—provides a good surface for skidded loads.

A special plastic material in the nailing grooves between the channels seals itself when the nails are withdrawn, maintaining a tight floor at all times. Securely welded to the underframe, the channels act as a rigid, horizontal diaphragm and strengthen the entire car.

NAILABLE STEEL FLOORING

A GREAT LAKES STEEL PRODUCT

Nailable Steel Flooring is cold-formed from tough, corrosion-resistant N-A-X HIGH-TENSILE for high cantilever strength, impact-resistance and wearability. It's flat and smooth—can't be ripped up by unloading tools. Under normal operating conditions it's expected to last as long as the car itself. Cars decked with Nailable Steel Flooring spend less time on the rip tracks and in the shops—save dollars in floor repair and replacement costs.

REDUCES OPERATING COSTS AND DAMAGE CLAIMS, TOO!

Because it handles *all* types of gondola and boxcar freight, Nailable Steel Flooring cuts down switching and assembly operations and empty car movement. Turn-around time is lowered, car supply improved, operating costs reduced!

Nailable Steel Flooring has no splinters or sharp edges to rip sacked goods. Spilled liquids aren't absorbed. Blocking is more secure, because nails are gripped with greater force than in wood—yet can be readily removed with no damage to the floor. All this means more protection to goods in transit—and fewer damage claims!

In new car construction and old floor replacement, Nailable Steel Flooring can *save money three ways.* Write for descriptive booklet.

GREAT LAKES STEEL CORPORATION

Steel Floor Division, Detroit 18, Michigan • Unit of National Steel Corporation

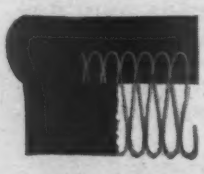
For additional information, use postcard, pages 41-42

Because most materials become as brittle as glass when exposed to —110° F., Pure Carbonic Inc. experienced difficulty in securely sealing the doors of refrigerator cars that transport "Dry-Ice." Losses due to evaporation through leaky doorways often ran as high as 35%. Then Inner-seal was tried.

A Pure Carbonic Inc. refrigerator car, specially designed for transporting "Dry-Ice."

It remained soft and flexible in spite of the intense cold. The resilient neoprene-coated sponge rubber bead made a tight, contour-conforming seal. Doorway evaporation losses dropped to approximately 3%, and the savings realized quickly paid for the Inner-seal installation.

Unique in design, easy to install, Bridgeport Inner-seal is the strongest, most flexible weather stripping for industrial applications. It is manufactured in many standard sizes and colors or may be specially designed for unusual applications. It will pay you to get the cold facts on Inner-seal. Write today for data sheet giving complete information.



Tough spring steel wire molded for life into live sponge rubber coated for this application with neoprene that resists sun, oil, and extreme temperature variations.

Bridgeport
FABRICS, INC.
BRIDGEPORT 1, CONN.
Est. 1837

Represented in Canada by
THE HOLDEN CO., LTD., Montreal, Toronto, Winnipeg and Vancouver, B. C.

cessors, has retired because of ill health. Mr. Barrows was appointed chief engineer of the original Symington Company in June, 1915, and has been vice-president of Symington-Gould since October, 1920.

◆

JOSEPH T. RYERSON & SON.—*Earl R. Nelson* has been appointed manager of the Cincinnati, Ohio, plant of Joseuh T. Ryerson & Son, to succeed *Wayne D. Dukette*, who will head the company's new steel-service plant now under construction in the San Francisco, Cal., area. The company has completed new offices and a large addition to the existing warehouse facilities at East Fifty-third street and Lakeside avenue, Cleveland, Ohio.

◆

WHEEL TRUING BRAKE SHOE COMPANY.—The Wheel Truing Brake Shoe Company of Detroit, Mich., has appointed the *St. Louis Railway Supply Company*, St. Louis, Mo., as agents for abrasive brake shoes.

◆

BENDIX AVIATION CORPORATION.—*George M. Anger* has been appointed western states representative for the Scintilla Magneto division of the Bendix Aviation Corporation, Sidney, N. Y. Plans are being made to establish an office in San Francisco, Calif., where Mr. Anger will maintain his headquarters.

George M. Anger

◆

GENERAL ELECTRIC COMPANY. — *W. V. O'Brien* has been appointed assistant general manager of sales for the apparatus department of the General Electric Company.

◆

CLIMAX MOLYBDENUM COMPANY.—*Norman L. Deuble* has joined the metallurgical engineering staff of the Climax Molybdenum Company. Before joining Climax Molybdenum, Mr. Deuble was with the M. W. Kellogg Company in charge of special processes and the work in the high temperature laboratory.

◆

AMERICAN BRAKE SHOE COMPANY. — *N. George Belury*, formerly sales manager of the American Brake Shoe Company, has been appointed vice-president of the company's engineered castings division, and *Harry C. Platt*, formerly division metallurgist, has been appointed works manager. Both will continue to maintain headquarters in Rochester, N. Y.

The American Brake Shoe Company's two non-ferrous foundries recently completed at Niles, Ohio, and Meadville, Pa., were opened on December 8 and 9, respectively. The new Meadville plant will produce bronze bearings and castings. It will specialize in copper, brass and bronze for railroads, steel mills and other industries and in precision machine bearings for Diesel engines. The new foundry at Niles will manufacture railroad journal bearings.

◆

WESTINGHOUSE AIR BRAKE COMPANY.—*Lawrence Wilcox*, representative of the Westinghouse Air Brake Company at Chicago, retired on December 1. On that date Mr. Wilcox became secretary and treasurer of the Air Brake Association.

◆

PITTSBURGH STEEL FOUNDRY CORPORATION.—*Clyde L. Hassel* has been appointed vice-president in charge of sales and engineering of the Pittsburgh Steel Foundry Corporation, at Glassport, Pa. He succeeds *E. S. Weidle*, resigned, in the sales position. Mr. Hassel has been associated with the corporation since 1924.

◆

PRESSED STEEL CAR COMPANY.—*John I. Snyder, Jr.*, a director of the Pressed Steel Car Company since January, 1947, has been elected chairman of the board of directors, with headquarters in Pittsburgh, Pa.

John I. Snyder, Jr., began his business career with Kuhn, Loeb & Co. in 1936

John I. Snyder, Jr.

and has resigned as manager of the buying department of that company to accept the chairmanship of Pressed Steel. It has also been announced that the office of the president of the company has been moved to Chicago where the domestic appliance division is located.

◆

AMERICAN ARCH COMPANY. — *Samuel MacClurkan*, vice-president of the American Arch Company will henceforth make his headquarters at 332 South Michigan avenue, Chicago. Mr. MacClurkan's duties remain the same.

◆

GOODYEAR TIRE & RUBBER CO. — *Allan Weber* has been appointed special railroad representative in the eastern United States for the Goodyear Tire & Rubber Co., with headquarters in New York, to succeed *R. B. Warren*, who has been appointed

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WHEN YOU HAVE THE RIGHT TUBE EXPANDER

airetool makes a complete line of tube expanders for every railway requirement

Whatever the size . . . whatever the requirement . . . there's an Airetool Tube Expander for every type of Railway tubular construction. Precision built of alloy steels, and heat treated for uniform grain and hardness, Airetool Tube Expanders are made right . . . to do the job right . . . to give dependable, long, hard service.

The No. 3426 and G-1600 Airetool Expanders illustrated are for flaring and expanding in one operation.

. . . AND THE RIGHT TUBE CLEANERS TOO!

Illustrated is the Airetool No. 4325 Cleaner — GE Head — for Nicholson Syphons. The complete Airetool Railway Tube Cleaner line includes cleaners for Automatic Blow Down Pipes . . . Arch Tubes . . . Circulating Tubes.

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AUTOMATIC
PROCESSING CONTROL

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★ GEOMETRIC ACCURACY
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★ HEAVY STOCK REMOVAL
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In many different installations have cut total processing by one or two operations—have reduced the over-all amount of waste stock removal—have generated uniform final size AUTOMATICALLY within 0.0001 to 0.0003-inch—eliminated selective fits in some parts—reduced inspections to one or two spot checks per shift.

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Los Angeles, Calif. • Houston, Texas • Rockford, Ill. • Guilford, Conn. • Brantford, Ont., Can.

Pittsburgh, Pa., district manager for the mechanical goods division.

◆

JOHN A. ROEBLING'S SONS COMPANY.—*L. H. Van Dike, Jr.* has been appointed as Detroit, Mich., representative of the Roebling Company, replacing *Harry T. Hirbe,* who died on November 24 in his thirty-first year.

Mr. Van Dike, a former lieutenant in the USNR, is a graduate of Dartmouth

L. H. Van Dike, Jr.

College and the Tuck School of Business Administration. He has been associated with Roebling since 1946.

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—In order that he may have more time to devote to accounts in his territory, *R. E. Thayer,* vice-president of the Simmons-Boardman Publishing Corporation, has relinquished the duties of business manager of *Railway Mechanical Engineer,* in which post he has been succeeded by *C. W. Merriken, Jr.*

◆

FAIRBANKS, MORSE & CO.—*H. L. Gebhard,* general Diesel locomotive foreman of the Illinois Central, at Chicago, has been appointed a sales engineer of Fairbanks, Morse & Co. at Chicago. *C. B. O'Neil,* manager of the F-M railroad department at St. Louis, Mo., has been placed in charge also of sales of Diesel locomotives in the St. Louis area and the southwest. Mr. O'Neil succeeds to the duties of *Frank Ross,* resigned. *J. C. Elmburg,* manager of the Boston, Mass., branch of Fairbanks-Morse, has been transferred to the Atlanta, Ga., branch in the same capacity, to replace *G. N. Van Epps,* resigned. *V. O. Harkness,* formerly manager of the Diesel division at Chicago, has been appointed manager of the Boston branch to succeed Mr. Elmburg, and *T. M. Robie* succeeds Mr. Harkness.

Obituary

FREDERICK ALBERT CROFT, vice-president and assistant general manager of the Magnus Metal Division of the National Lead Company, with headquarters at Chicago, died on November 20, in the Evanston (Illi) Hospital. Mr. Croft was born in Chicago on November 1, 1880, and attended public schools and business college in that ciyt. In 1908, he was appointed assistant manager of the St. Louis (Mo.) plant of the Hewitt Manufacturing Company (later

For additional information, use postcard, pages 41-42

● Note that these Engineer's Pattern "Superrenches" are thin enough to operate jam nuts.

YOU GET STREAMLINED STRENGTH WITH WILLIAMS "Superrenches"

Awkward, hard-to-reach adjustments present no problem for these streamlined "Superrenches". Forged from alloy steel, they are light in weight yet their strength is equal to that of the strongest wrenches made. Available in all popular patterns, with openings from 3/16" to 3-1/8". "Superrenches", with highly polished heads, are handsomely finished in durable chrome plate, over nickel.

J. H. WILLIAMS & CO., BUFFALO 7, N. Y. *Distributors Everywhere*

Magnus Metal Company). Mr. Croft was given jurisdiction over the operations of

Frederick Albert Croft

all of the Magnus western plants in 1927 and was appointed vice-president and assistant general manager of the Magnus Metal Division, National Lead Company, in 1936.

JOSEPH TURNER RYERSON, former president and treasurer of Joseph T. Ryerson & Son, Inc., at Chicago, and a director of this firm, the Inland Steel Company and the Belden Manufacturing Company, died on December 7 at St. Luke's hospital in Chicago, following a brief illness. Mr. Ryerson was 67 years old.

Personal Mention

General

J. L. ROACH, superintendent of motive power of the Fort Worth & Denver City and the Wichita Valley at Childress, Tex., has retired.

W. H. MCAMIS, acting superintendent of motive power of the Chicago & North Western, at Chicago, has been appointed superintendent of motive power at Chicago, with jurisdiction over locomotive and car matters, Western district.

G. S. ROBERTSON, general foreman of the Fort Worth & Denver City and the Wichita Valley (both parts of the Burlington Lines), at Childress, Tex., has been appointed superintendent of motive power, with headquarters at Childress.

Diesel

A. R. SNYDER, mechanical superintendent of Diesel power of the Union Pacific at Omaha, Neb., has had his headquarters transferred to Salt Lake City, Utah. Mr. Snyder at Salt Lake City will be centrally located with respect to the area in which the Diesel locomotives are chiefly used.

Master Mechanics and Road Foremen

F. O. FERNSTROM, who has been relieved, at his own request, as shop superintendent of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has been appointed master mechanic, with headquarters at Milwaukee.

R. F. BATCHMAN, general foreman enginehouse at Englewood, Ill., of the New York Central, has been appointed assistant master mechanic at DeWitt, N. Y.

BARRY GLEN has been appointed master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at Chicago.

THOMAS C. ROBINSON has been appointed assistant master mechanic of the New York, New Haven & Hartford, with headquarters at Harlem River, N. Y.

A. M. MARTINSON, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has retired after 50 years of service with the railroad.

F. W. BUNCE, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at Chicago, has been appointed master mechanic at Milwaukee, Wis.

Electrical

VIRGIL F. DOWDEN has been appointed engineer, car electrical equipment, of the New York, New Haven & Hartford.

Car Department

JOSEPH F. CLEMO, assistant general foreman car repairs of the Southern at Birmingham, Ala., has been appointed general foreman car repairs at Selma, Ala.

HENRY F. MORRISON has been appointed assistant foreman freight-car repairs at the Hayne car shop of the Southern at Spartanburg, S. C.

Shop and Enginehouse

ARTHUR E. MAYO has been appointed assistant superintendent of shops of the New York, New Haven & Hartford at Van Nest, N. Y.

ERNEST J. KELLY has been appointed superintendent of shops of the New York, New Haven & Hartford at Van Nest, N. Y.

OSCAR L. POND has been appointed assistant enginehouse foreman of the Southern at Greensboro, N. C.

H. CLARK SCOVILLE has been appointed resident engineer at the Van Nest, N. Y., shops of the New York, New Haven & Hartford.

W. RUPERT LONG has been appointed night enginehouse foreman of the Southern at Selma, Ala.

WALTER P. SEBASTIAN has been appointed night foreman of the Southern at Greensboro, N. C.

WALTER B. WARREN, night foreman of the Southern at Greensboro, N. C., has been appointed general foreman at Selma, N. C.

CLYDE A. LOW has been appointed chief inspector at the Van Nest, N. Y., shops of the New York, New Haven & Hartford.

BOYDEN P. TAYLOR has been appointed general foreman at the Van Nest, N. Y., shops of the New York, New Haven & Hartford.

Bakes or Dries
Coils & Armatures
Automatically
NO Watching • NO Timing

- Hi-volume horizontal air flow.
- Automatic heat control.
- Positive fresh air intake.
- Controlled volatile exhaust.
- Uniform temperature.
- Economical to operate.
- Easy to load and unload.

HERE'S AN OVEN that saves time on urgent motor repair jobs. This DESPATCH S Oven reduces baking time 25 to 35%, and bakes *automatically*—without watching or timing!

Average load for this 6'x6'x6' oven is 72 armatures and 100 complete coil sets. Daily capacity is 216 armatures, 300 complete coils. Temperature: 300°F. to 450°F. Time: variable up to 6 hours—ave. 4 hours at 300°F. Direct gas fired convection heat . . . automatic, safe (Factory Mutual approved).

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GREAT NORTHERN Shops, St. Paul, bakes two 3-ton 36" diameter armatures for diesel-electrics in 12 hours with this DESPATCH Oven.

DESPATCH OVEN COMPANY

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